

KA
KOT GEOMETRY
THYMMAI



DA U

BAH FRANK M. PUGH, M. A.

**La shon
ha Shillong
Printing
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Chapel Road
Shillong**

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THYMMAI

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LA PYNNIH DA U NONGTHOH.

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DAIAW, SHILLONG.

1963.

KA 'TIENLAM-PHRANG

Ka jingdawa jong ka rukom hikai thymmai ia ka Geometry (ba ngi khot ka *Practical Geometry*) ia kane ka juk thymmai mynta, ka la pynlong bam banse shuh ban thaw bad thoh ia kane ka Geometry Thymmai.

Ha kaba thoh ia kane ka kot don lai saw tylli ki jingthmu kiba la pynlong ia u nongthoh ban ialeh-
iap ia ka ban pyndep pynbiang., (1) Katba lah synei, u nongthoh u pyrshang ban ialam ia ki khynnah rit kiba dang sdang ia kane ka subjek ban bang bad ban sngewtynnat ia ka da kaba pynlong ia ki ba kin leh hi, ha ka rukom ialehkai byrngia. (2) U la ialeh-
iap de ban bud ban pynwan bad pynbiang ia ka jingdawa ki skul, kat ka jingdawa ki por mynta bad ka jingkwah ka *curriculum* ki skul (3) Hynrei ryngkat bad kata, um klet ruh ba dei ban seng ka nongrim kaba skhem bad khlain bha ia ki ia kaba kin lah pat hadien habud ban bud bad ioh kem ia ki jinghikai ba kham sha khlieh kiba ia id da ka jingpynshongnia, ym da kaba shu bud matlah na ki jingshem kawei ar ki nuksa (deductive method and not inductive only). (4) La slem u nongthoh u la iohi ba dei ban pynbiang ia ki skul riawlum ha kane ka bynta ia kaba la leh ruh ha ki thain dkhar baroh; (kat kumba lah ban iohi na ka *curriculum* rim ba la ai harum), hynrei um shym ioh lad ban pynmih madan, tad ynda don na ki lok kiba la leit iohi kiba la kyntu jur ba dei ban nym set ia la ka jingtip na kiwei de. Kumta u sngewdei ba ia ka jingtip ba u la ioh da kaba lum nangne naugtai bad da kaba iai duriap thop kumno ban pynlongkam ia

kata ha la ka ri, ban nym shu song noh ha ka rumar bad tep ĩa ka hapoh khyndew, lane tap noh da u khiew, ne ban buhrieh hapoh ka shang ne ha khrum jyingthiah, u la kut jingmut noh ba dei ban ai lem ĩa kiwei de, kiba lah ban ĩoh bor ĩoh mynsiem ne jingmyntoi nangne bad ban trei khambha ki kam kiba kham khr w pat shadien, katba nangĭaid ki por.

Kumta bad kine ki jingthmu, ĩa kaba la ĩoh ei dei ban ai ei, la pyllait ĩa ka sha ki Kh n ka Ri ki ban long khl r long bnai lashai lashiengi, ban ai jingshai bad jingkdew lynti ha ki por dum ka miet syn ia.

Yn ĩai pdiang da kaba sngewnguh sngewburon ĩa kino kino ki jingĭapyni lem ne jingkdew ĩa ki jingwit kumno kumno ĩa ka ban nang kham pynbha ĩa ka kot ĩa ka ban bit ban biang ki khyannah rit ha ka Ri lashai lashiengi.

Ia ki jingbakla ki barit baria hangne hangtai kiba ĩaid lait na ki khmat, bad ĩa ki jingkhlih ki dur de hamar ba shon sngewbha ĩam p.

Ja aw, Shillong.

Khublei baroh.

30-1-63.

NONGTHOH.

*OLD CURRICULUM**Class IV.*

Definition of Geometrical terms : Practical Geometry namely drawing and various Geometrical diagrams by the use of the ordinary Geometrical Instruments.

Class V.

More difficult exercises in Practical Geometry than in class IV.

Class VI.

Practical Geometry—Division of straight lines, angles ; drawing of perpendiculars and parallel straight lines ; construction of triangles and measurement of circles ; and theoretical proofs involved in the operations.

*NEW CURRICULUM**Class IV.*

Conception of straight line and point from the faces, edges and corners of solids and by actual drawing.

Drawing of a straight line through a point, joining of two points by a straight line. Measurements of straight lines—uses of rulers and dividers. Measurements of angles in degrees.

Drawing of perpendiculars and parallel straight lines and their definitions—Uses of Set Squares.

Drawing of circles—uses of Compasses—definitions of circles, circumference, radius, diameter, chord and arc.

Drawing and measurement of angles—uses of the Protractor—definitions of complementary and supplementary angles.

Triangles—classification of triangles.

Class V.

Straight line—length and direction—drawing of simple plans to scale in inches and tenths of inches.

Bisection of a straight line.

Bisection of an angle.

Construction of an angle equal to a given angle.

Construction of right angles and angles 60° , 45° , 30° and $22\frac{1}{2}^\circ$.

Construction of a line parallel to a given straight line through a given point.

Construction of triangles from a given data.

Quadrilaterals—parallelograms, rectangle, square, rhombus and trapezium.

Construction of quadrilaterals from given data.

Polygons—regular polygons.

Circle.

Class VI.

Divisions of degrees into minutes and seconds.

Congruence of triangles : by drawing and paper cutting.

Practical Proofs of the following constructions.

- (1) To bisect a given straight line.
- (2) To draw a given angle.
- (3) To draw an angle equal to a given angle at a point in a straight line.
- (4) To draw a straight line perpendicular to a given straight line from a point in and outside the line.

Construction of triangles from the following given data :—

- (1) Three sides of a triangle.
- (2) The sides and the included angle.
- (3) The base and the two base angles.
- (4) The hypotenuse and a side of a right-angled triangle.
- (5) Two sides and an angle opposite to one of them.

Construction of quadrilaterals from the following data :—

- (1) Four sides and an angle between pair of sides.
- (2) Four sides and a diagonal.
- (3) Two adjacent sides of a parallelogram and an angle between them.

- (4) To draw a square on a given straight line.

Circle—Constructions to show the following :—

- (1) Perpendicular drawn through the middle point of a chord passes through the centre.
- (2) Perpendiculars drawn through the middle points of chords of a circle intersect at the centre.

- (3) Construction of circles passing through the vertices of triangles and squares.

KI JINGKDEW IA KI LYNNONG BAD KI PEIJ

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KA JINGPYNĪ NA KHMAT

Ki khynnah kin kynmaw ba ha kaba leh ĩa kine ki Jingpyrshang (Exercises) ha ka Geometry, kaba shu ring antad da ka kti ĩa ki lain, *angle* bad *circle*, kam biang, bad ym bit da lei lei ban shu leh kumta. Donkam ka jingbniah kaba thik pa thik, ha kaba thew ĩa ki lain bad ki *angle*, bad kham tam ha kaba ring ĩa ka *circle*. Ban lah ban leh ĩa kanc, dei ban pyndonkam barobor ĩa ki tiar Geometry, bad kine harum ki long kiba leit-kam bha.

1. U *Flat ruler*, lane u *scale*, uba don jingthaw ha kawei ka liang ha ki inshi, ba la pynbynta ha ki 10 bynta, bad ha kawei ka liang pat ha ki *centimetre* bad *millimetre*.

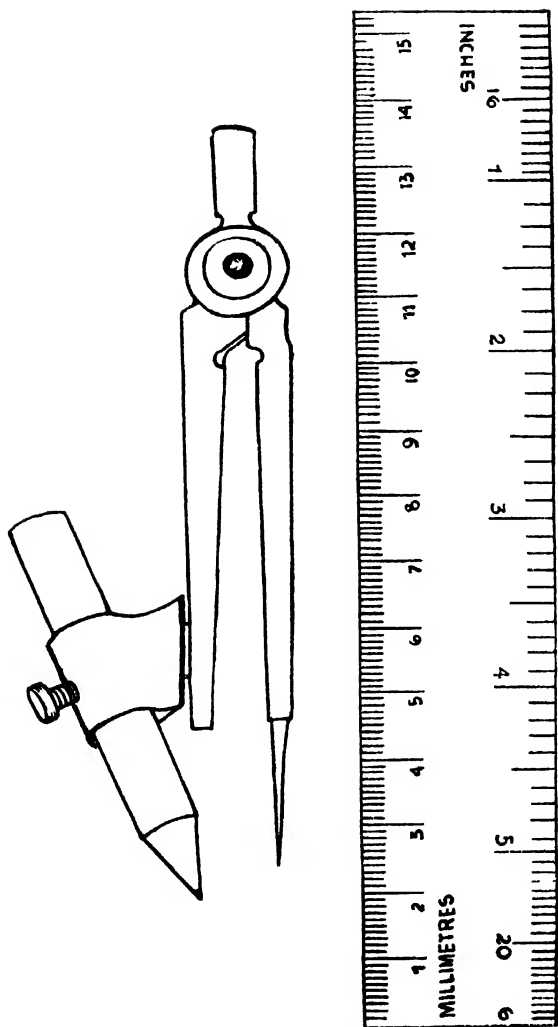
2. U *Compass* (ne nap ring *circle*), ha kaba ki kynja *circle* baroh la ju ring da une.

3. Ka *Protractor*, da kaba lah ban thew ĩa ki *angle* baroh naduh 0° haduh 180° .

4. Ar tylli ki *Set Square*, kawei kaba don ki *angle* 45° baroh ar ; kawei pat ki *angle* 60° bad 30° . Kine ki ĩarap ban ring lain kiba *parallel* (ki bam ĩakyn-duh).

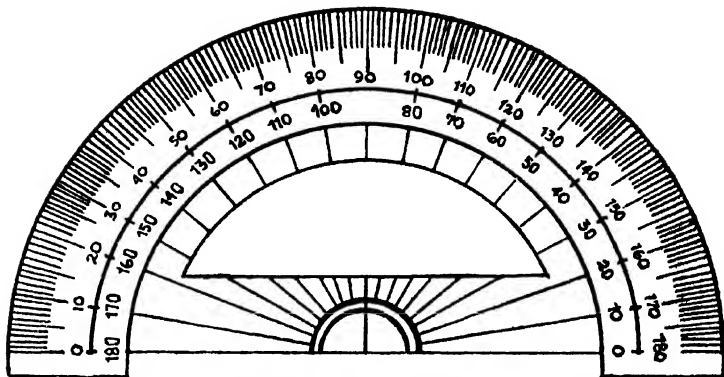
5. U *Divider*, da uba lah ban thew ĩa ka jing-jngai u lain lada donkam ban pynĩabynta ĩa u.

Ia kine yn sa nang ai jingbatai shuh shadien, katba nangĩaid ha ki lynnong.

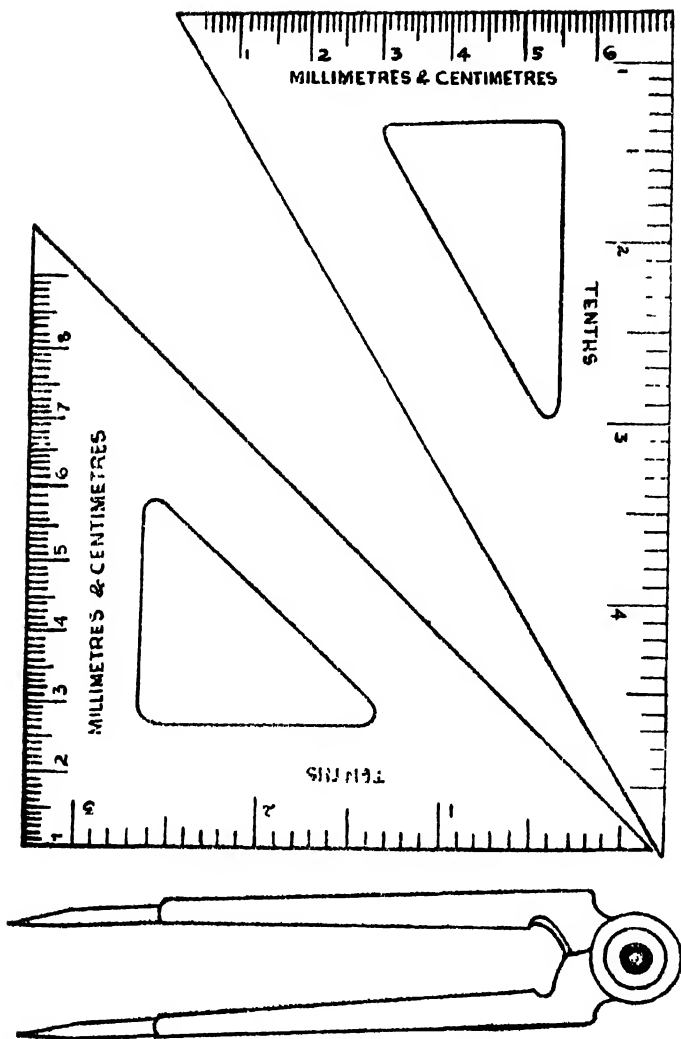


U Compass and a Flat Ruler.

X



Ka Protractor.



U Divider bad 2 tylli ki Set Square.

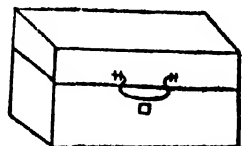
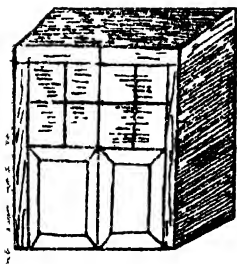
KA KOT GEOMETRY THYMMAI

BYNTA 1.

1 SOLID : SLA (SURFACE); LAIN ; POINT

KA SOLID :— Khmih ha kine ki dur harum—

Ngi lah ban thew ia ka lynter, ia ka pyngkiang bad ia ka jingrben jong ki. Lada ngi shim ia ka kot ruh ngi lah ban leh kumjuh hi. Ngi



lah ban thew kumjuh ruh ia ka ben, ia ka miej kiba don hajan jong ngi. Ngi lah ban shem katno ka lynter, katno ka pyngkiang bad katno ka kynjang jong ki. Ia kum kine ki dur ngi khot kyrteng **Solid.**

1. Ka Solid ka long kaba don ka lynter, ka pyngkiang bad ka jingrben.

KA SLA (SURFACE) : Haba ngi tba ãa ka miej, ka bol ne u sohñiamtra ngi tba ãa ka sla ne ka snep jong ka Haba ngi ñiad rong bad pushara ngi leh tang na jrong lane ãa kaba ha sla. Ia kaba hajrong ne ha sla ngi khot *Sla* ne *Surface*. Kane ka don tang ka lynter bad ka pyngkiang. Kam don jingrben

2. Ka Sla ne Surface ka long kaba don tang ka lynter bad ka pyngkiang.

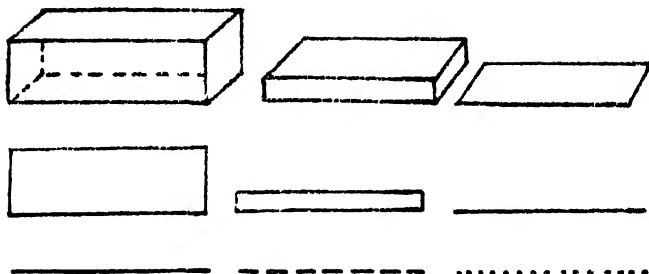
U LAIN :— U pud uba ker ãa ka miej, ka ben ne ka kot, u long u lain. U jingthoh ksai uba siat beit na kawei ha kawei ka dong ngi khot u *Lain*. Ia une u lain ngi thew tang ãa ka lynter. Um don pyngkiang ne jingrben.

3. U Lain u long uba don tang ka lynter.

U POINT :— Ngi lah ban buh dak iba rit tang da u khmut let ne thyrnia. Ia ine i dak rit ngi khot i *Point*. Ym ju lah ban thew ãa ka lynter ne jingheh une u dak. Kumta u *point* u long u bam don jingheh ei ei.

4. U Point u long uba don tang i dak rit bad u bam don jingheh ei ei.

Kumta ngi iohi harum :—



- (1) Ia ka Solid la ker na ki dong da ki sla, *lane*, Bún syrtap ki sla la pynlong ka Solid.
- (2) Ha ki dong jong ka Sla don ki Lain, *lane*, Haba ia syrtap bún ki lain ki pynlong ka Sla.
- (3) Ha ki tduh jong u Lain don ki Point, *lane*, Bún ki point ba iasoh lang ter ter ki pynlong uwei u lain.

U Lain u don lai rukom :—

- (1) Uba beit (2) Uba khun bad (3) Uba kdor.

Khmih ha kine ki nuksa harum :—



- (1) uba beit (2) uba khun (3) uba kdor.

Ha ka Geometry ngi dei pule tang ia ki lain ki ba beit bad ba khun. Ngim dei pule ia kiba kdor. U lain uba beit u siat ryntih kum u khnam. U beit

baroh shilynter na u point ha u point. U lain uba khun u khun kum u sai-ryntieh bad kum u bnai ne ka sngi.

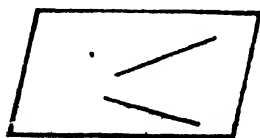
5. U lain uba beit (straight line) u long uta u lain uba beit baroh shilynter na uwei u point ha uwei u point.

6. U lain uba khun (curved line) u long uta u lain uba khun ryntih na uwei u point sha uwei u point.

Ia ki lain kdor ngim dei pule ha ka Geometry.

PLANE (PLEN) :— Pynthiah u *ruler* ha ka miej ne blakbord. Ring lain uwei. Uta u lain u beit sak. Buh ar tylli ki dak ne point ha ka miej ne blakbord Pyniasoh ia kita ki point. U lain u iauid beit sak. Pynjriong ia uta u lain. Uta u lain u iauid beit ryntih sak baroh shi lynter. Ia kane ka sla madan la ong ba ka long *plane* (plen).

Pynthiah pat u *ruler* ha ka bol (ne globe). Ring lain uwei. Uta u lain un khun, um beit. Buh dak ar tylli ki point ha ka bol (ne globe). Pyniasoh ia kita ki point bad pynjriong ia u lain. Uta u lain un nym beit hynrei un khun. Ia kane ka sla pylun la ong ba kam long ka *plane*.



Ka Plane



Ka Sla pyllun

7. Ka plane (plen) ne ka sla madan ka long kata ka sla ba madan ha kaba u lain ba pyniasoh ia kino kino ar tylli ki point ha ka u thiah beit baroh shilynter khlem khun ne kdor.

Ia u point ne lain ngi ju ai kyrteng ban pyn-
iapher na kiwei pat ki point ne ki lain.

A. .B KD.

Ngi khot u point **A**, u point **B**, u point **K** bad u point **D**. Haba ngi pyniasoh ia u point **A** bad **B** ngi khot u lain **AB** ne **BA**. Haba ngi pyniasoh ia u **K** bad u **D** ngi khot noh u lain **KD** lane **DK**.

JINGPYRSHANG I

1. Ring u lain **AB** uba beit. Ring u lain **KD** u bam beit. Batai uei u lain. Don katno rukom ki lain ?

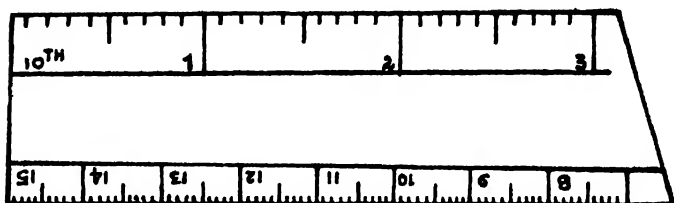
2. Ring ar tylli ki lain kiba beit. Na ki tduh jong ki, para baajan pyniasoh da kiwei pat ki ar tylli ki lain kiba beit. Ia kine ki tduh la khot kiei ha ka Geometry ? Ia kane ka dur baroh kawei kaba la ker da ki saw tylli ki lain phi khot kaei ? Batai shaphang jong ka.

3. Ring dur ia kawei ka bol, ka synduk bad ka khoh. Ki khot kiei kum ia kine ki dur ha ka Geometry ? Ai jingbatai balei ba la khot ia ki kumta ?

4. Ring dur ia u lain, ka *surface* bad ka *Solid*. Batai ia ka jingmut jong ki.

5. Yn syrtap lang bún kiei ban pynlong ka *surface* ? Ha ki tduh u lain don kiei ?

2. KA JINGPYNDONKAM IA U RULER BAD U DIVIDER



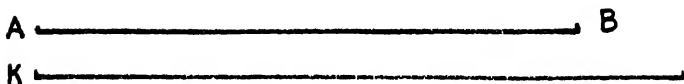
Haba ngi ring lain ngi pyndonkam da u *ruler* (rular). Haba ngi kwah ban thew u jrong katno u lain ngi thew da u *ruler*. U *ruler* u don ar tylli ki jingthew. Ha kawei ka dong ne liang u don ki inshi haduh 6 inshi. Shi inshi ka long kat ka pyngkiang ka shipiah. Ia ka shi inshi la pyabynta ha shiteng bad ki 10 bynta kiba rit. Kumta ngi lah ban ring u lain uba 2 inshi, uba 2 inshi shiteng bad 2 inshi la 8 dak rit.

Ia u 2 inshi shiteng ngi ring 2 bad sa shiteng inshi, hapteng u 2 bad u 3 inshi. Ia u 2 inshi la 8 dak rit ngi ring 2 inshi bad sa 8 tylli ki dak rit hapteng u 2 bad u 3.

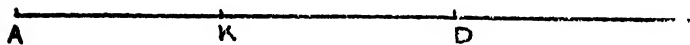
Ia u inshi la shu thoh lyngkot tang in, lane " ha khlich. U 2 inshi shiteng u long 2 dak heh bad sa 5 dak rit. Kumta ia u 2 inshi shiteng la thoh ruh 2.5 in lane 2.5". Bad ia u 2 inshi 8 dak rit la thoh 2.8 in lane 2.8".

JINGPYRSHANG 2.

1. Thew ïa kine ki lain harum bad thoh :—



2. Thew bad thoh ïa u **AK**, **KD** bad **DB** ha kine harum bad sa adlang. Thew pat sa ïa u **AB** bad khmih ki ïaryngkat ne ém ?



Ring ki lain kiba :—

1'5" ; 4 3" ; 3'7" ; 4'9" ; '8" ; '5" ; 5'6".

KI CENTIMETRE (SENTIMITAR).

Ha kawei ka dong jong u *ruler* don ki inshi, ki jingthew Phareng. Ha kawei pat ka dong don ki jingthew Phrensh ba la khot *centimetre* (sentimitar) bad *millimetre* (millimitar).

Ki dak heh ki don kumba 15 tylli ha u *ruler* ha ki jingthew Phrensh. Ia kine la khot *centimetre* (sentimitar). Ia ka shi *centimetre* la pynbynta ha ki 10 bynta ki dak rit. Ine i dak rit i long shi *millimetre*. Kumta 10 *millimetre* = 1 *centimetre*. Ia kine ruh ngi ring lain kumjuh kum ha ki inshi.

Ia u *centimetre* ngi thoh lyngkot cm bad ia u *millimetre* pat mm. Ia u 6.3 cm ngi ring dak 6 dak heh bad 3 dak rit. Kumta 6.3 cm = 63 mm, lane 63 mm = 6.3 cm. Lada phah ring lain 79 mm, ring 7 dak heh bad 9 dak rit, lane 8 dak heh duna noh shi dak rit.

JINGPYRSHANG 3.

1. Thew ia kine ki lain ha ki *centimetre*.

A _____ B

K _____ D

2. Iathuh katno *millimetre* kitei ki lain ki don ?

3. Ring lain kiba :—

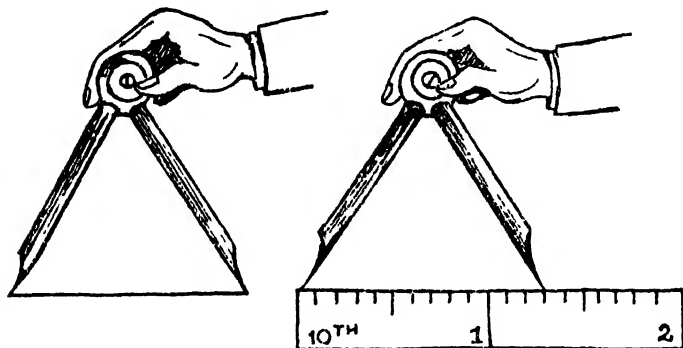
5.1 cm ; 6.9 cm ; 73 mm ; 10.7 cm.

4. Ring lain kiba 3" bad 5 cm. Wad ia ka narshiteng jong ki.

5. U lain uba 4" u long katno ha ki *centimetre* ; bad u lain uba 6 cm u long katno ha ki inshi ?

KA JINGPYNDONKAM IA U DIVIDER (DIBAIDAR)

Kumno ngi pynlonkam ãa u *divider* ?



Haba ngi kwah ban thew ãa u lain, ngi kad ãa u khmut *divider* (dibaidar) bad ngi pynháp ãa ki khmut ha ki tduh u lain. Nangta ngi rah ãa u *divider* bad sa thew ha u *ruler* (ne *scale*). Ngì khmih bad ñiew katno inshi ne *centimetre* u lain u don.

Ngì lah ban ring lain, ar lai shah da ka jingārap u *divider*, ryngkat bad u *ruler*. Tharai ngi kwah ring lain 3 shah ãa u 1'3". Ngì ring lain 1'3" da u *ruler*, bad ngi thew da u *divider*. Nangta ngi jām sa arsien jām ha u lain uba ßeit narud u *ruler* ban long 3 shah.

Da une ujuh u *divider* ngi pynbynta ãa u lain. Haba ngi pynbynta ar bynta ãa u lain uba 6 inshi, ngi kad da u *divider* 3 inshi, ha u skel (*scale*) 'ne

ruler bad sa pynhap ha u lain. Haba ngi pynbynta 3 bynta ãa u lain 6 inshi, ngi kad tang 2 inshi ãa u *divider* ha u skel, bad kumta de ãa kiwei kiwei de.

U lain uba 4·8" u long 48 ki dak rit ha ki inshi. U dak uba 4·8 cm u long 48 mm, kata 48 ha ki dak rit *millimetre*. U 4·8" u long 4 dak heh bad 8 dak rit. $4·8" = 4 \times 10 + 8 = 48$ dak rit. Shiteng ãa u 48 u long 24, kata 2·4". Haba pynbynta 3 ãa u 48 ka long 16. Kata u long 1·6".

JINGPYRSHANG 4.

1. Ring u lain 2" bad pynjrong arshah da u *divider*.

2. Ring lain 2·8" bad pynjrong laishah da u *divider*.

3. Ring lain 3·7 cm bad pynjrong sawshah da u *divider*.

4. Ring lain uba 5". Jám marshiteng da u *divider*.

5. Ring lain **AB** uba 9·6 cm. Wad ãa ka shiteng jong une bad jám da u *divider*. Nangta wad sa marshiteng biang ãa uta. Kumta un long shi pawa ãa uba mynshuwa.

6. Pynbynta 3 bynta, 6 bynta ãa u lain uba 5·4" da u *divider*.

7. Ring u lain **AB** uba 8·4 cm. Ot **AK** marshiteng biang ãa u **AB**; bad sa ot **AD** pat shi pawa ãa u **AB**. Shem da u *divider* katno tylli ki **KD** ki don ha u **AB**. Katno *millimetre* u **KD** u don?

8. Thew 2 inshi da u *divider* bad thew pat ha u jingthew *centimetre*. Don katno *millimetre* ha ka 1 inshi ?

9. Thew 13 cm bad pyniabiang ha u jingthew inshi. Shi *centimetre* un long katno inshi ?

10. Na u point **O** ring saw tylli ki lain **OA**, **OB**, **OK**, **OD** kiba 3'2", 3'5", 8 cm, 87 mm.

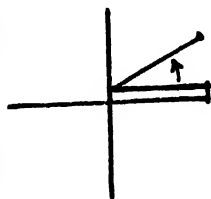
3. KA ANGLE

KA JINGPYNDONKAM IA KA PROTRACTOR

Lada shim ia ka kluainshi bad kad ia ka, ka pynlong ka jingang. Ia kane ka jingang ngi khot *angle*. Shim ar tylli ki dieng rit ne let, pyniada it sbiak ha ki khmut jong ki. Nangta kad ne pied ia uwei na ki haduh un da ialong lain bad uta uwei pat. Hangne kine ki dieng ki pynlong ka *angle*. Lada nang kad shuh shuh ia uta uwei un kylla pyrdet bad wan phai biang sha kajuha ka jaka na shadien. Kumta unc u dieng rit u tawiar ia lade baroh sawdong.

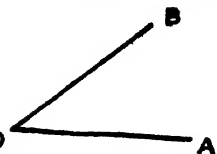
1. Kumta ngi shem ba haba ar tylli ki lain ki ba beit ki iakynduh ki pynlong ka angle.

Ki dong ha ki jingkhong bad jingkhong iit ki long *angle*. Ki long ki jaka ha kaba iashem u lain lyntang. Ki khynnah ki lah ban shna kuin ki *angle* ha ki kti ki kjat.

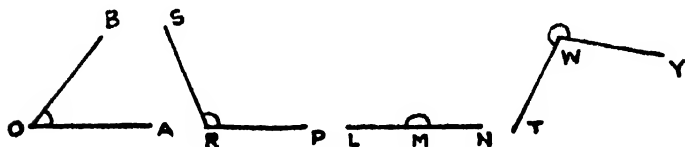


Ia ki angle ngi da ai kyrteng. Haba u lain **OA** uba beit u iakynduh bad uwei pat u lain **OB** uba beit ki pynlong ka *angle* ha u **O**. Bad ngi khot ia kane ka *angle* ha u **O**, ka *angle* **AOB** lane ka *angle* **BOA**.

Lada ngi pynjrang ia ki **O** lain **OA** bad **OB**, ka *angle* ka sah hi katjuh. Kam heh lymne kam rit. Hynrei lada ngi pied pyniar ia u **AO** ne **OB**, ka *angle* kan nang heh nang heh.



Kine ki dur harum kin pyni ba ki nang heh nang heh. Bad ngi ai kyrteng ia ki da ki kyrteng kiba iapher ba phin jer kyrteng hi.

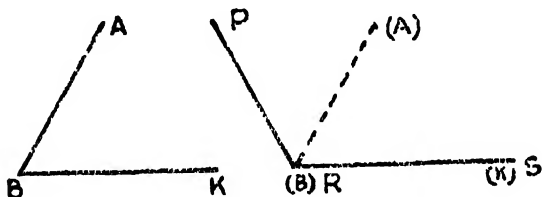


Ngi shu thoh lyngkot \angle , ia ka *angle*. Kumta ngi ong ka \angle **AOB** lane ka \angle **BOA**. **OA** bad **OB** ki long ki *arm* (lane ki *ksangkti*), namar ki ker ia ka *angle* **AOB**. Ia ki point **O**, **R**, **M** bad **W** ha kitei ki dur haneng la khot ki *vertex* (Berteks).

2. Ki arm (lane ksangkti) jong ka angle ki long ki lain kiba ker ia ka angle.

3. Ka vertex (berteks) ka long ka khmut ne ka tduh jong ka angle ha kaba ia kynduh ki lain.

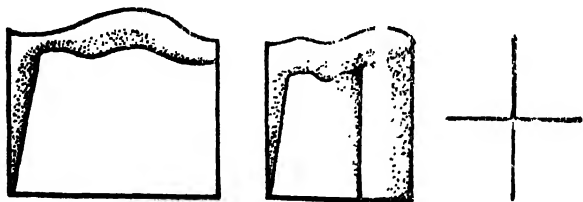
*Kumno ngin tip la ka angle **ABK** bad ka angle **PRS** ki iaryngkat ne em.*



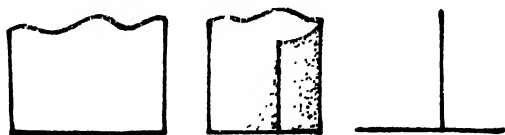
Ngi trud (trace) pynbud ia ka angle **ABK** ha i kot sada. Nangta ngi rah ia ka angle **ABK** ha i kot sada. Nangta ngi rah ia ka \angle **ABK** sha ka \angle **PRS**. Ngi pynháp ia i point **B** ha i point **R** bad ia u lain **BK** ha u lain **RS**. Nangta ngi pynháp ia u lain **AB** shaneng u **RS**. Lada ki iaryngkat ki angle, u **BA** un háp thik ha u **RP**. Lada ka angle **KBA** ka kham rit kan rung hapoh ka angle **SRP** kum ha ka dur.

KA RIGHT (RAIT) ANGLE — Shim kano kano ka kot sada. Khylliap ia kata ar khylliap da pynbeit lain ha ki dong. Nangta khylliap najan marshiteng sa ar khylliap da leh kumjuh. Plied blang ia ka. Yn mih saw tylli ki lain. Kine ki lain ki pyn-

long saw tylli ki *angle* kiba beit Kine baroh saw tylli ki *angle* ki iaryngkat kawei ia kawei. Ia kawei pa kawei na kine ki *angle* ngi khot ka *Right Angle*.



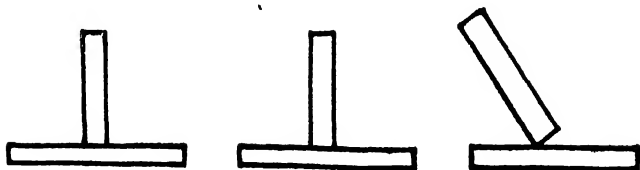
Kumjuh, shim da ka kot sada kaba kawei na ki dong jong ka ka long kaba beit lain. Khylliap sbiak hamar uta u lain uba beit. Yn mih ar tylli ki *angle* kiba beit. Kine ki ialong katjuh ka jingheh. Kine ruh ki dei ki *Right angle*.



Ki *angle* ha ki dong kynroh ne jingkhangiit ki long baroh ki *right angle*.

Shim ar tylli ki let ne dieng rit kiba beit. Pynieng ia uwei hajan marshiteng jong uwei pat. Lada u ieng beit thik, ki *angle* baroh arliang jong u ki

heh katjuh. Hynrei lada um ieng beit bad u kham noh shiliang, kawei na ki *angle* kan kham heh ia kawei pat.



4. (a) Lada uwei u lain u ieng halor uwei pat u lain kumta ba ki *angle* ha baroh arliang jong u ki iaryngkat, ia kita ki *angle* la khot ki Right Angle; bad ia u lain ba pynlong right angle ngi khot noh Perpendicular.

4. (b) Kumjuh ruh lada ar tylli ki lain ki iapom kum uplus + kumta ba kine saw tylli ki *angle* ki iaryngkat kawei ia kawei, kine ruh ki long ki Right Angle. Bad uno uno na kine ki lain u long u Perpendicular.

Kumta haba iapom saw tylli ki lain mih saw *right angle*. Haba uwei u lain u ieng halor uwei u lain mih ar *right angle*, ha kawei ka liang. Kumta don ka shi *right angle*, ka ar *right angle*, ka lai *right angle* bad ka saw *right angle*.

KI ANGLE BUN RUKOM



5. Ia ka angle kaba kham rit ia ka shi right angle ngi khot ka acute (akiwt) angle.

6. Ia ka angle kaba iaryngkat ia ka ar right angle ngi khot ka straight (streit) angle.

7. Ia ka angle kaba kham heh ia ka shi right angle, hynrei kaba duna ia ka ar right angle ngi khot ka obtuse (obtiws) angle.

8. Ia ka angle kaba don hapteng ka ar right angle bad ka saw right angle ngi khot ka reflex (riphleks) angle.

Ia ka right angle la phiah ha ki 90 tylili ki bynta ba iaryngkat. Ia kine ki bynta ngi khot ka degree (digri). Ia ka degree la shu thoh lyngkot $^{\circ}$. Kumta—

Ka right angle ka don 90° .

Ka straight angle ka don 180° .

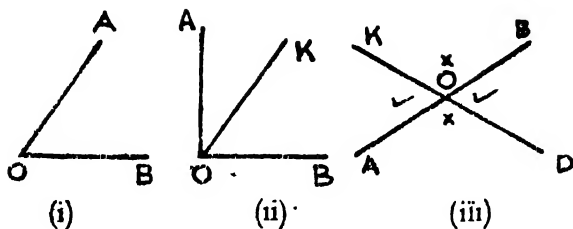
Ka acute angle ka don duna ia ka 90° .

Ka obtuse angle ka don hapteng 90° bad 180° .

Ka reflex angle ka don hapteng 180° bad 360°



Khmiĥ bĥa ĩa ka rukom jer kyrteng ĩa ki *angle*. Khmiĥ ha kine ki dur harum.



Ha ka dur (i) ĩa ka *angle* ha u **O**, ngi khot kyrteng ka $\angle \mathbf{AOB}$ lane ka $\angle \mathbf{BOA}$. Ngı pynháp ĩa u point **O** hapteng. Ha ka dur (ii) ngi don ki $\angle \mathbf{AOK}$ bad \mathbf{KOB} , lane ki $\angle \mathbf{BOK}$ bad \mathbf{KOA} . Kine ki \angle ki long ki *angle* ba ĩamarjan lane ba ĩalong *adjacent* \angle .

9. Ki ar tylli ki angle ba don sha kadiang bad kamon jong ujuh u lain ki long ki angle ba ĩamarjan bad la khot ki adjacent angle.

Ha ka dur (iii) ngi don ki $\angle \mathbf{AOK}$, \mathbf{KOB} , \mathbf{BOD} bad \mathbf{DOA} , lane ki $\angle \mathbf{AOD}$, \mathbf{DOB} , \mathbf{BOK} bad \mathbf{KOA} . Ki $\angle \mathbf{KOB}$ bad \mathbf{AOD} ruh ki ĩaphai pyrshah ki khmut, kumjuh ruh ki *angle* \mathbf{AOK} bad \mathbf{BOD} ki ĩaphai pyrshah ki khmut ne *vertex*.

10. Lada ar tylli ki lain ki ĩapom uwei ĩa uwei, ĩa ki angle ba ĩapyrshah ki khmut la khot ki vertically opposite angle, lane ki angle ba ĩapyrshah ki vertex.

Ha ka dur (ii) haba ka \angle **AOK** bad ka \angle **KOB** ki ialong lang shi *right angle*, kawei ka *angle* ka pyndap ia kawei pat ban long shi *right angle*.

11. Ia ki shijur ki angle kiba iapyndap ban ialong shi right angle lane 90° la ong ba ki ialong Complementary. Ia kawei kawei na kine ki angle ba iapyndap shi right angle pat ngi khot ka Complement jong kawei pat.

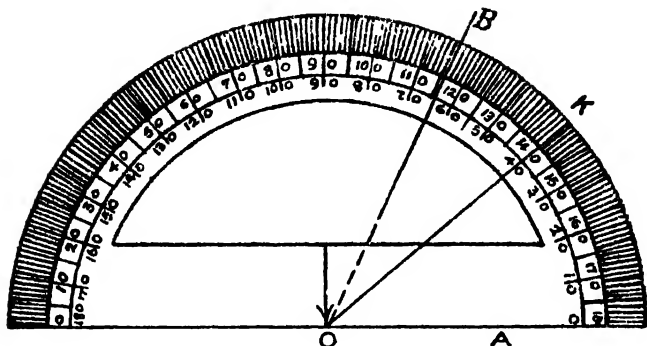
Ha ka dur (iii) ka \angle **AOK** ka pyndap ia ka \angle **KOB** ban long 180° lane 2 *right angle*.

12. Ia ki shijur ki angle kiba iapyndap 2 right angle kawei ia kawei ngi ong ba ki ialong Supplementary. Ia kawei kawei na ki shijur ki angle ba iapyndap kawei ia kawei ban long ar right angle ngi khot ka Supplement jong kawei pat.

Haba ka \angle **AOK** ka long 30° ka *Complement* jong ka kan long 60° ban pyndap ia ka shi *right angle* lane ia ka 90° . Haba ka \angle **AOK** ka long 45° ka *Complement* jong ka kan long $90^\circ - 45^\circ = 45^\circ$.

Haba kawei ka *angle* ka long 120° ka *Supplement* jong ka ban pyndap 180° , kan long 60° . Haba kawei ka *angle* ka long 35° ka *Supplement* jong ka ban pyndap 180° lane 2 *right angle*, kan long $180^\circ - 35^\circ$, kata 145° .

KUMNO BAN PYNDONKAM IA KA PROTRACTOR



Haba ngi kwah ban thew ia ka jingheh jong ka angle PRS, ngi leh kumne —

Ngi rah ia ka *protractor* ban pynháp ia u **OA** thik hamar u lain **RP**. Nangta ngi pynháp ia u point **O** uba don hamar shiteng jong ka *protractor*, thik hamar i khmut point **R**. Nangta ngi khmih hangno u lain **RS** u kdew. Lada u kdew hamar ka jingthoh 64° , haba ngi ñiew na sha ka liang u **A**, ngi ong ba ka angle **PRS** ka heh 64° .

Haba ngi kwah ban shna ia ka angle kaba heh 40° ngi leh kumne :—

Ngi pynháp ia ka *protractor* ha ka kot sada bad rul lain **OA** da u let. Nangta ngi khmih hangno u dak 40° u don ha ka lyngwiar jong ka *protractor* haba

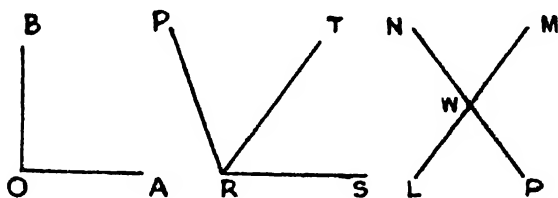
ñiew na ka liang u **A**. Ngi buh stop ne point **K** tiak iwei hamar pyrsah thik u dak 40° . Nangta ngi weng ia ka *protractor* bad pyniasoh ia u lain na u **O** ha uta u point **K**. Kane ka *angle* kan heh thik 40° . Kumjuh ruh ngi leh ia kiwei kiwei de ki *angle* ba kham heh ne kham rit.

Haba ngi kwah ia ka *Complement* jong ka 55° , ngi wad katno ka 55° ka duna na ka 90° . Bad kata ka long $90^\circ - 55^\circ = 35^\circ$.

Haba ngi kwah ia ka *Supplement* jong ka 55° , ngi wad katno ka 55° ka duna na ka 180° . Bad kata ka long $180^\circ - 55^\circ = 125^\circ$.

JINGPYRSHANG 5.

1. Thew ia ka jingheh kawei pa kawei na kine ki *angle* harum :—



2. Shna *angle* kaba heh 30° , 60° , 90° , 120° , 145° .

3. Shna *angle* kaba heh 45° , 63° , 77° , 121° , 159° .

4. Shna ia kine ki *angle* bad ia ki *Complement* jong ki de :—
 40° , 70° , 15° , 85° , 90° .

5. Shna ki *angle* kiba long *Supplement* ãa kinc :—
 120° , 110° , 91° , 67° , 32° , 180° .

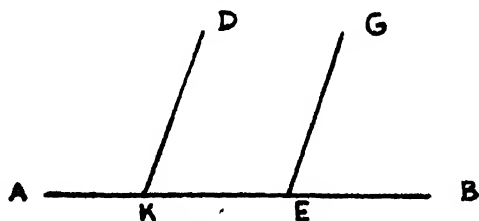
6. Shna *angle* kiba 57° , 90° , 137° , 180° , 270° , 360° . Phi khot kyrteng aũ ãa kinc ki *angle* ?

7. Shna ar tylli ki lain kiba ãapom, pynlong kawei na ki *angle* ban long 50° . Shem ãa ka jingheh jong kawei pa kawei na kiwei pat ki *angle*. Ia ki *angle* kiba ãa pyrshah kumne ki khmut phi khot kyrteng kiei ?

4. KI PARALLEL

KA JINGPYNDONKAM IA KI SET SQUARE

Don lai ngut ki briew kiba ãaleit lynti. Baroh lai ngut ki ãamih na kajuha ka jaka. U banyngkong u ãaid beita mihngi. Tang shu poi ha kawei ka jaka, u baar u khlad noh shaphang shatei lam mihngi, ha ka *angle* kaba 45° . Kita kiwei pat ki nang ãaiaid ha la ka lynti. Ynda poi ha kawei pat ka jaka, u balai u khlad lynti pat kumjuh shaphang shatei lain mihngi ha kajuha ka *angle* kaba 45° . Kita kiba iakhlad lynti arngut kin dang ãakynduh ne ém, da kaba nang ãaid sha khmat ne phai kylla dien, lada ki bud beita ãa la ki lynti jong ki ? Khmih nuksa ha ka dur harum:—



Ngi ring lain **AB** da pyngkiang. Bad ngi buh

dak **K** bad **E** ha u lain. Nangta ngi thew ki
 \angle **DKE** bad **GEB** kiba pynlong 45° bad u lain **AB**.

Ki arngut kiba ñaid ha u lain **KD** bad **EG**
 kin nym ñakynduh lano lano ruh, lada kin ñai bud
 ña ki lynti jong ki. Kine ki lain **KD** bad **EG**,
 namarkata, ki long ki lain ki bam ñakynduh shuh lano
 lano ruh, lada pynjrung ne pynjlán ña ki katno
 katno ruh.

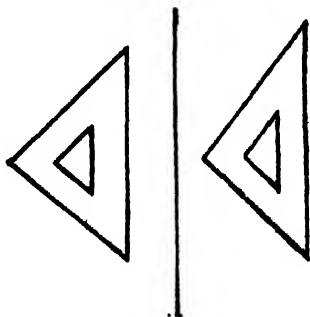
1. **Ia kum kine ki lain ki bam iakyn-
 duh katno katno ruh wat lada ring
 pynjrung ia ki katno katno ngi khot ki
 parallel.**

2. **U lain uba pom pynkynduh ia
 ki parallel ngi khot u Transversal.**

Ha katei ka dur, u **KD** bad **EG** ki long ki
parallel, bad u **AB** u long *Transversal*.

KI SET SQUARE (SKWER)

Ki **Set Square** ki don ar tylli. Kawei na
 ki ka don 90° ha kawei
 ka dong, bad ar tylli ki
 dong kiba ñaryngkat 45°
 kawei kawei. Kumta
 kawei ka dong ka long
 shi *right angle*, bad ki ar
 tylli kiwei pat ha ki ar
 tylli ki dong ki long 45°
 lane shiteng ña ka shi
right angle.



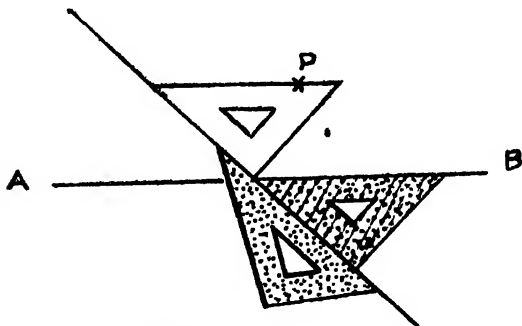
Kawei pat ka **set square** ka don 90° ha kawei ka dong, bad kiwei pat ki don ar tylli ki dong kiba 60° bad 30° kawei kawei.

Ring lain narud ki **set square** bad sa thew ia ki angle. Shem ki long ne ém kumba la batai ?

Ring lain barobor narud ne nabar ka **set square**, yin dei napoh ne shapoh ka **set square**.

Lyngba uwei u point P ring lain parallel ia uwei pat u lain AB

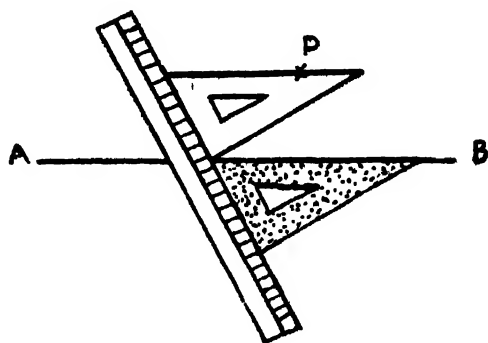
BUIT NYNGKONG.



Ring lain **AB** u bajrong da u ruler. Pynháp thik ia ka rymmiang bajlân jong kawei na ki *set square* hamar u lain, kum ha ka dur haneng. Nangta sa shim sa kawei ka *set square* bad pyniatyng-khuñ na shadien da ki dong bajlân, kumta ba ka banyngkong ka shaniah ha kane kaba hadien. Sa pynsyntuid ia ka *set square* banyngkong shaneng u lain. Shop ia ka suki bad khmih ba u point **P** un háp thik hamar ka rymmiang jong ka *set square*. Rul lain lyngba u **P** narud ka *set square*. Une u lain un long parallel ia u lain **AB**.

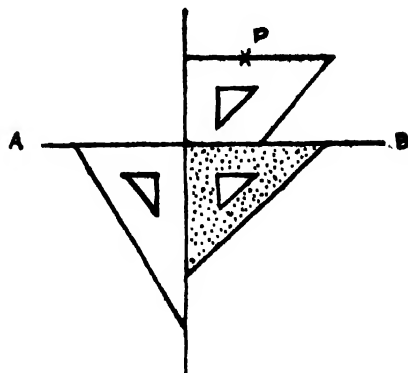
Lane, lah ban ring, lain parallel da ka jingiarap u ruler babha dong kum ha kane ka dur :—

BUIT KA BAAR.



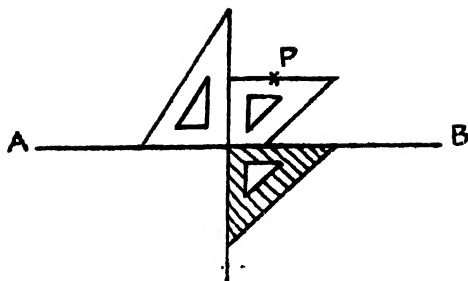
Lane, kham lah kumne :—

BUIT KA BALAI.



Dur (i)

Dur (ii)



Pynháp ãa ki dong *right angle* baroh ar jong ki *set square* hamar u lain **AB**. Kumta ba ki ãalong *perpendicular* baroh ar ha u lain **AB**. Ai ki *set square* kin long ha kawei ka liang u **AB** jngai na u **P**, kumta ba kin nym tap ãa u point **P**. Sa pynsyntuid ãa kawei na ki *set square* haduh kan da ãaháp lain bad u **P**. Ring lain ha u **P** narud ka *set square*.

JINGPYRSHANG 6.

1. Ring u lain **AB** da pyngkiang. Lyngba u point **O** haneng u **AB** ring lain parallel ãa u **AB**.

2. Ring u lain **AB** da pyngkiang. Lyngba u point **O** harum u **AB** ring lain parallel ãa u **AB**.

3. Ring lain **AB** da pynieng. Lyngba u point **P** uba don sha kamon u **AB** bad u point **R** uba sha kadiang u **AB** ring ki lain kiba parallel ãa u **AB**.

4. Ring lain ar tylli **AB** bad **KD** kiba ãaparallel, bad sa ot da u lain **EG**.

5. Ring u lain **EG**. Na u **E** bad u **G**, ring lain ar tylli **ER**, **GP** kiba ãaparallel. Pynjrong ãa u **RE** sha u **T** bad **PG** sha u **S**.

6. Shna ka angle **ABK** kaba 60° sha kamom. Lyngba u **A** ring lain **AD** uba parallel ia u **BK**.

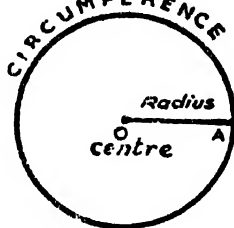
7. Shna ka angle **DBK** kaba 120° sha kadiang. Lyngba u **D** ring lain **DA** uba parallel ia u **BK**.

5. KI CIRCLE (SARKL)

KA JINGPYNDONKAM IA U COMPASSES

Ia ki lain kiba beit ngi ring da ka jingiarap u *ruler* ne u *scale* (skel). Ia ki lain kiba khun rynthi ngi ring da u *compasses* (kompass).

Buh dak ia i point **O** ha ka kot sada. Shim ia u *compasses* ha ka kti bad kad shiteng inshi ($\frac{1}{2}$ ") ha ka jingthew *ruler*. Buh ia u khmut nar hamar i point **O** bad ring tawiar da u let baroh sawdong haduh ban da kut. Kane ka dur ka long kaba pyllun thik. Ngì khot ia kane ka dur ka *Circle* (Sarkl ne Jylli).



Ia i point **O** hapdeng ka *circle* ngi khot ka *Centre* (sentar lane ka Pdeng). Ia u pud uba ker tawiar baroh sawdong ka *centre* ngi khot *Circumference* (Sarkompherens).

Phin shem ba ka jingjngai na *centre* **O** ha u pud, kata ha ka *circumference*, ka long barobor katjuh. Lada phi teh da u ksai na u khmut nar ha u khmut let kan long hi baroh katjuh. Lada

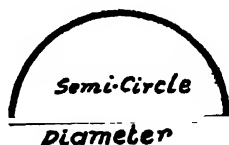
ka jingngai kam long katjuh ka dur kan nym pyllun bha. Ia ka jingngai na u **O** ha u pud ngi khot noh u *radius* (redios).

1. **Ka Circle (Sarkl)** ka long ka dur ka ba pyllun ba la ring ha sla kaba ma-dan. La ker ia ka da uwei u lain bakhun ryntih. Ia une u lain uba khun la pyn-long da kaba ring tawiar ia u point uba khiih jngai katjuh na u point uba hapdeng.

2. Ia ka pdeng jong ka *circle* la khot ka *centre* jong ka.

3. **Ka Circumference** jong ka *circle* ka long u pud uba ker sawdong ia ka *circle*.

4. U *Radius* jong ka *circle* u long u lain ba la ring na ka *centre* sha ka *circumference* jong ka.



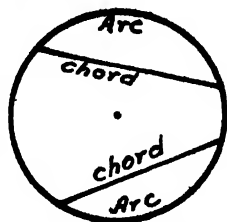
Ring biang kawei ka *circle* da u *radius* 1'2 cm. Ring pat uwei u lain uba ia id lyngba ka *centre* na ka *circumference* sha ka *circumference*. Une u lain u phiak arhang phiak ia ka *circle* bad u ia ryngkat ar tyll ki *radius*. Ia une u lain ngi khot u *diameter* bad ia kane ka dur marshiteng jong ka *circle* ngi khot ka *semi-circle*, kata, ka Shi-teng-Sarkl.

5. U *Diameter* u long u lain jong ka *circle* ba la ring na ka *circumference* sha ka *circumference* lyngba ka *centre*.

6. Ka Semi-circle ka long ka shi-teng jong ka circle ba la ker da u diameter bad ka circumference ba la ot da u.

Ring circle kaba da u *radius* $\frac{1}{2}$ inshi. Na kino kino ki point ha ka *circumference* ring lain sha kiwei pat ki point ha ka *circumference*. Kita ki long kum ki ksai kiba pyrkhun ia ka ryntieh. Ia kine ki lain la khot *Chord* ne ki *Ksai Ryn-tieh*.

Ring circle da ujuh u *radius* khlem pynkut ne pynkynduh ia ka *circumference*. Kine ki lah ban long kiba la pyllun bha, ne kiba sdang pyllun malu mala. Ki long kum ki simpyllieng ne khilon. Kine ki long ki bynta jong ka *circumference*. Ia kine la khot ki *Arc* ne *Khilon*.



7. U Chord u long uta u lain uba pyn-iasoh kino kino ki ar tylli ki point kiba ha ka circumference.

8. Ka Arc ka long kano kano ka bynta jong ka circumference.

JINGPYRSHANG 7.

1. Ring circle kawei da u *radius* 1.5". Buh point **A, B, K, D** hamar ka *circumference*. Ring lain na ki sha ka *centre* **O**. Thew ki ialong katno ?

2. Na u point **O** ring lain **OA**, **OB**, **OK**, **OD** kiba iaryngkat $1\frac{1}{2}$ ". Ring *circle* da ka *centre* **O** bad u *radius* uba iaryngkat ia u **AO**. Kane ka *circle* kan iaid lyngba ne ém ia u **B**, u **K** bad u **D** de? Batai balei?

3. Ring kawei ka *circle* da u *radius* 1 ". Ring sa kawei ka *circle* harud da ujuh u *radius* 1 ". Ring lain na ki *centre* sha ki *circumference*. Thew ia kine ki *radius* ha baroh ar ki *circle*. Ki long katno inshi? Ki iaryngkat ne ém?

4. Ring u lain **AB** uba $3\frac{1}{2}$ cm. Na *centre* **A** bad da u *radius* 2 cm ring *circle* kawei. Na *centre* **B** bad da ujuh u *radius* 2 cm ring *circle* sa kawei. Ai kin iapom ha ki point **D** bad **E**. Pyniasoh **AD**, **BD**, **AE**, **BE**. Thew ia kine ki lain. Ki iaryngkat ne ém? Balei?

5. Ring *circle* kawei da u *radius* $3\frac{1}{2}$ cm. Pyni ha ka dur, uno u *radius*, u *diameter* bad u *chord*? U *diameter* u jrong katno shah ia u *radius*? Ka *arc* ka iapher kumuo na ka *circumference*?

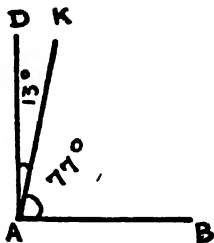
6. Ring uwei u lain **AB**, uba $1\frac{1}{3}$ ". Na ka *centre* **A** ring *circle* da u *radius* **AB**. Na ka *centre* **B** ring *circle* biang da ujuh u *radius*. Ki iapom ne ém? Ring lain na ki jaka ba iapom. Wad ia ka shiteng u **AB**.

7. Ring u lain **AB** uba $2\frac{1}{2}$ ". Na ka *centre* **A** ring *circle* da u *radius* 1 ". Bad da ka *centre* **B** ruh ring *circle* da u *radius* 1 ". Ki iapom ne ém? Balei? Yn leh kumuo ba kin iapom?

6. KA JINGTHEW ANGLE DA KA PROTRACTOR

1. Shna ña ka angle kaba 77° bad ña ka *Complement* jong ka.

Ngi shim ka *protractor* bad rul lain **AB** narum jong ka. Ngi buh dak **A** ha tduh u lain **AB**. Ngi pynháp ña ka tduh **A** jong une u lain **AB** hamar shiteng jong u lain *protractor*, uba don dak khnam. Ngi khmih ha ka lyng-wiar ba ruid dak, bad wad ña u 70° . Nang'a ngi ñiew sa 7 dak rit sha khmat u 70° ban long 77° . Ngi buh dak stop ne point ha ita i dak, (tharai) **K**. Ngi weng ña ka *protractor*. Bad ngi ring lain na ita i dak **K** sha u point **A** jong u lain **AB**. Kata ka angle kan long 77° .

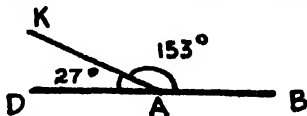


Ngi wad pat katno ka 77° ka duna na ka 90° . Ngi shem ba ka long 13° . Kumta ngi ring angle pat kumjuh **KAD** kaba 13° . Namar 77° bad 13° ki long shi *right angle*, lane 90° . Kine ki ñalong *Complement*.

Lane ngi ring lypa ka \angle **BAD** kaba 90° bad ka \angle **BAK** kaba 77° . Ka \angle **DAK** kan sa shu long hi 13° .

2. Shna ka \angle kaba 153° bad ña ka *supplement* jong ka de

Ngi ring da ka *protractor* ña ka angle **BAK** kaba 153° . Ngi shem ba $180^\circ - 153^\circ = 27^\circ$.

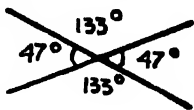


Kumta ngi ring angle biang **KAD** sa kaba 27° . Namar $153^\circ + 27^\circ = 180^\circ$ lane 2 *right angle*.

Phin shem ba u lain **DA** bad **AB** ki ialong tang shi lain. Kumta lah ban ring lypa u lain **DAB** bad sa shna ka \angle **BAK** kaba 153° bad ka \angle **KAD** kan sa shu long hi 27° .

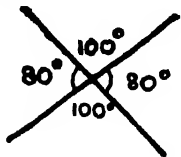
3. Ring ar tylli ki lain kiba iapom uwei ia uwei pat. Pynlong kawei na ki angle ban long 47° . Shem ia ka jingheh kawei pa kawei na kiwei pat ki angle.

Ngi thew bad shna shuwa kawei ka angle kaba 47° da ka *protractor*. Nangta ngi ring pynjrung ia ki lain sha lyndet ka khmut angle. Ka angle baiapyrshah ken long katjuh kat kaba mynshuwa. Kata kan long 47° . Ka angle baiamarjan ka ia long supplement bad ka angle 47° . Kumta kan long $180^\circ - 47^\circ$ lane 133° . Lada thew ia ka angle baiapyrshah ki khmut bad ka, ruh kan long hi 133° .



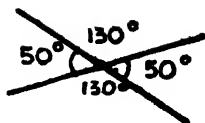
4. Haba ar tylli na ki lain ki ia pom, bad lai tylli na kita ki angle kin long lang 260° . Shem ia kawei pa kawei ka angle. Pyni da ka dur.

Baroh saw tylli ki angle ki ialong lang 360° . Namar ba lai tylli ki long 260° . Kaba sah na ki kan long $360^\circ - 260^\circ = 100^\circ$. Ka paramarjan jong ka 100° pat kan long $180^\circ - 100^\circ = 80^\circ$. Bad ka angle baiapyrshah ki khmut bad ka 100° kan long hi 100° . Bad ka angle baiapyrshah ki khmut bad ka 80° kan long hi 80° . Kumta ki angle baroh saw tylli kin long 100° , 80° , 100° , 80° kawei kawei.



5. Ar tylli ki lain ki iapom uwei ia uwei pat. Ar tylli na kita ki angle baiapyrshah ki ialong lang 260° . Shem ia kawei pa kawei ka angle. Da ring bad ka dur.

Ar tylli ki angle baīapyrshah ki ĭalong mar katjuh bad baroh ar ki long 260° . Kawei kawei ka long $260^\circ \div 2 = 130^\circ$. Bad ki angle ba- ĭamarjan bad ki pat ki long $180^\circ - 130^\circ = 50^\circ$ kawei kawei.



Ki angle ki long 130° , 50° , 130° , 50° .

JINGPYRSHANG 8.

1. Ring dur bad shem ĭa ki *Complement* jong kine :— 30° , 60° , 45° , 53° , 90° .

2. Ring dur bad shem ĭa ki *Supplement* jong kine :— 50° , 75° , 90° , 180° , 0° .

3. Ring ar tylli ki lain kiba ĭapom uwei ĭa uwei pat, ki da pynlong saw tylli ki angle. Shem ĭa ka jingheh kawei pa kawei ka angle, lada kawei na kita ki angle ka long—

(i) 60° , (ii) 77° , (iii) 146° .

4. Ar tylli ki lain ki ĭapom uwei ĭa uwei pat. Ring dur bad shem ĭa ka jingheh kawei pa kawei ka angle, lada lai tylli na ki angle ki ĭalong lang :—

(i) 270° , (ii) 300° , (iii) 279° .

5. Ar tylli ki lain ki ĭapom uwei ĭa uwei pat. Ring dur bad shem ĭa ka jingheh kawei pa kawei ka angle, lada ar tylli na ki angle baīapyrshah ki ĭalong lang :—

(i) 120° , (ii) 180° , (iii) 240° , (iv) 158° , (v) 222° .

6. Shna angle kiba long *Complement* ĭa kine:—

57° , 33° , $\frac{1}{2}$ rt. \angle , $\frac{3}{4}$ rt. \angle , $\frac{5}{8}$ rt. \angle , $\frac{7}{10}$ rt. \angle , $\frac{1}{8}$ rt. \angle .

7. Shna angle kiba ialong *Supplement* ia kine : —

15° , 47° , 63° , $\frac{1}{2}$ rt. \angle , $\frac{11}{16}$ rt. \angle , $\frac{11}{16}$ rt. \angle ,
 $\frac{9}{16}$ rt. \angle .

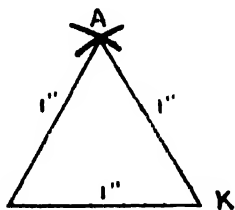
7. KI TRIANGLE

KA JINGPYNIAPHER IA KI TRIANGLE KAT KUM NA
 KI LAIN KIBA KER IA KI

Buh dak lai tylli ki point **A**, **B** bad **K** hangno hangno. Wat ai ba baroh lai kin don ha ujuh u lain. Pyniasoh ia kita ki point baroh lai da ki lain **AB**, **AK** bad **BK**. Tc kane ka dur ka long lai dong. La ker ia ka da ki lai tylli ki lain. Ka don hapoh jong ka, lai tylli ki *angle*. Ia kane ka dur ngi khot ka **Triangle**.

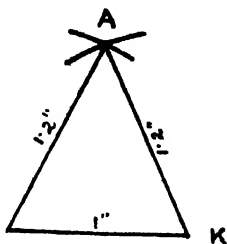
1. Ka Triangle ka long ka dur ba ha sla ba la ker ia ka da ki lai tylli ki lain.

Ring u lain **BK** uba jrong $1''$. Kad u *compasses* $1''$. Shim centre na u **B** bad ring arc shaneng da u *radius* uba $1''$. Nangta shim centre sa na u **K** bad ring arc biang shaneng da ujuh u *radius* $1''$. Ai kin iapom **B** ha u point **A**. Pyniasoh **AB**, **AK**. Ha kane ka triangle ki lain jong ka baroh lai ki iaryngkat Ngi khot ia ka ka *equilateral triangle*.



2. Ka Equilateral triangle ka long kata ka triangle ba baroh ki lain kiba ker ia ka ki iaryngkat.

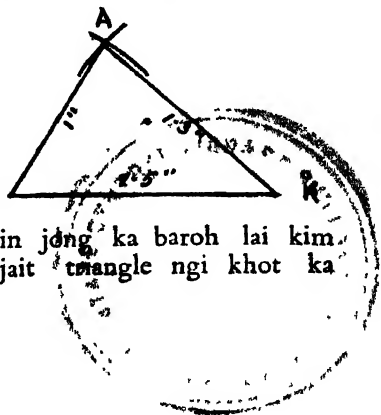
Ring biang u lain **BK** uba $1''$. Na centre **B** ring arc shaneng da u radius $1.2''$. Bad na centre **K** ring arc biang shaneng da ujuh u radius $1.2''$. Sa pyniasoh ia u **B** bad **K** ha u point **A**, ka jaka ha kaba ki iapom. Ha kane ka triangle ar **B** tylli ki lain kiba ker ia ka ki iaryngkat. Ngi khot ia ka ka *isosceles* triangle.



3. Ka Isosceless triangle ka long kata ka triangle kaba ar tylli ki lain kiba ker ia ka ki iaryngkat.

Ring u lain **BK** uba jrong $1.5''$. Kad u compasses $1''$. Shim centre na u **B** bad ring arc shaneng da une u radius $1''$. Nangta kad u compasses $1.3''$. Na centre **K** bad da une u radius $1.3''$. ring arc biang shaneng ban iapom ia kaba mynshuwa ha u **A**. Pyniasoh **AB**, **AK**. **B**

Ha kane ka triangle, ki lain jong ka baroh lai kim iaryngkat. Ia kane ka jait triangle ngi khot ka *Scalene*.



4. Ka Scalene Triangle ka long kata ka triangle kaba baroh ki lai lain kiba ker ia ka kim iaryngkat.

Ia ka triangle la shu thoh lyngkot \triangle

Ka $\angle A$ ka pyrshah ia u lain **BK** ne ia u lain **a**.

Ka $\angle B$ „ „ „ „ „ **AK** „ „ „ „ **b**.

Ka $\angle K$ „ „ „ „ „ **BK** „ „ „ „ **k**.

Kumta ia u lain baiapyrshah ia ka $\angle A$ la khot lyngkot u lain **a**, ia ka $\angle B$ u lain **b** bad ia ka $\angle K$ u lain **k**.

KA JINGPYNIAPHER IA KI TRIANGLE KAT KUM NA
KI ANGLE KIBA DON HAPOH JONG KI

Shna ka *angle ABK* kaba heh 90° lane kaba long shi *right angle*. Pyniasoh **AK**. Kane ka Triangle ka don kawei ka *angle* kaba long ka *right angle*.

5. Ia ka Triangle kaba don kawei ka angle kaba long shi right angle ngi khot ka Right-angled Triangle.

Shna ka *angle* kaba heh ia ka 90° hynrei duna ia ka 2 *right angle*. Pyniasoh ia ki tduh jong ki *arm*. Kane ka triangle ka don kawei ka *angle* kaba long *obtuse*.

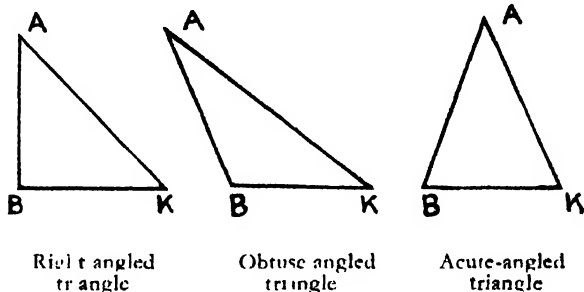
6. Ia ka Triangle kaba don kawei ka angle kaba long ka obtuse angle ngi khot ka Obtuse-angled Triangle.

Ring u lain **BK**. Ha u point **B** shna ka $\angle KBA$ kaba duna ia ka 90° . Ha u point **K** ruh shna ka $\angle BKA$ kaba duna ia ka 90° . Ai ki lain **BA**, **KA** kin iakynduh ha u **A**. Thew ia

ka $\angle A$ ha u point **A**. Kane ka $\angle A$ ruh kan duna ña ka 90° . Kumta ba baroh ki *angle* ha kane ka triangle ki ñalong *acute*.

7. Ia ka Triangle kaba don baroh lai tylli ki angle kiba long acute angle ngi khot ka Acute-angled Triangle.

Kine harum ki long ki nuksa :—



KA JINGIADEI KI ANGLE JONG KA TRIANGLE BAD
KI LAIN KIBA KER IA KA

Ring uno uno u lain **BK**. Ha u point **B** shna ka $\angle KAB$ kaba 60° . Ha u point **K** ruh shna ka $\angle BKA$ kaba 60° . Ai ki lain kin ñakynduh ha u **A**. Thew ña ki lain baroh lai jong kane ka triangle **ABK**. Phin shem ki ñaryngkat baroh lai. U **AB** = **AK** = **BK**. Thew sa ki *angle* baroh lai. Phin shem ki *angle* ruh ki ñaryngkat baroh lai. Ka $\angle A = \angle B = \angle K = 60^\circ$.

Na kane ngi ñohi, haba ki lain baroh lai jong ka triangle ki ñaryngkat, ki *angle* baroh lai jong ka ruh ki ñaryngkat. Lane, haba ki *angle* baroh lai jong

ka triangle ki iaryngkat, ki lain jong ka triangle ruh kin iaryngkat. Ha ka *equilateral triangle*, ki *angle* baroh lai jong ka barobor ki iaryngkat 60° kawei kawei.

Shna kano kano ka *equilateral* shem ka long kumta ne ém ?

Ring biang uno uno u lain **BK**. Ha u point **B** shna ka \angle **KAB** kaba 72° Ha u point **K** ruh shna ka \angle **BKA** kaba 72° hi. Ai ki lain kin iakynduh ha u **A**. Thew ia ki lain baroh lai. Phin shem tang ar tylli ki iaryngkat, tang u **AB** = **AK** Thew ia ki *angle* baroh lai. Ki *angle* ruh tang ar tylli kiba iaryngkat, \angle **B** = \angle **K**.

Na kane ngi iohi, haba ar tylli ki lain jong ka triangle ki iaryngkat ki *angle* jong ka ruh tang ar ki iaryngkat. Bad kita ki *angle* ki long kiba iapyrshah ia ki lain ba iaryngkat. Lane, haba ar tylli ki *angle* ki jong ka triangle ki iaryngkat, ki lain baiapyrshah ia ki ruh ki iaryngkat. Ha ka *isosceles triangle* ki *angle* baiapyrshah ia ki lain baiaryngkat barobor ki iaryngkat.

Shna kano kano ka *isosceles triangle*, shem ka long kumta ne ém ?

8. Ia ki lain baker ia ka triangle ngi khot ki side (said) jong ka.

9. Ia u lain ba ha trai jong ka isosceles triangle ngi khot u base (bes).

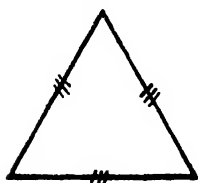
10. Ia ka angle ba ha khlieh jong ka isosceles triangle ngi ju khot ka vertical angle.

Ring u lain **BK** uba 1". Ha ki tduh jong une u lain shna ka \angle **KBA** kaba heh 70° bad ka \angle **BKA** kaba heh 50° . Pynkynduh ia u **BA** bad

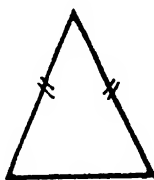
KA ha u **A**. Thew ia ka \angle **BAK**, kan long 60° . Kumta ki *angle* jong kane ka triangle kim iaryngkat baroh. Ka \angle **A** = 60° , ka \angle **B** = 70° bad ka \angle **K** = 50° . Thew sa ia ki lain kiba ker ia ka. Kine ruh kim iaryngkat. Kumta kane ka dur ka long ka *Scalene Triangle*.

Ngi iohi nangne ba haba ki *angle* ha ka triangle kim iaryngkat, ki lain kiba ker ia ka ruh kim iaryngkat. Lanc haba ki lain baker ia ka triangle kim iaryngkat, ki *angle* hapoh jong ka ruh kim iaryngkat. Ngi shem ba u lain baheh tam u dei uba pyrshah ia ka *angle* ka baheh tam. Bad u lain barit tam u pyrshah ia ka *angle* kaba rit tam.

Ngi pyni nuksa kumne harum :--



Equilateral \triangle



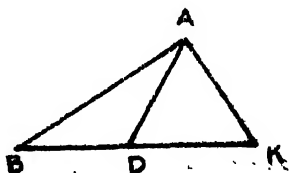
Isosceles \triangle



Scalene \triangle

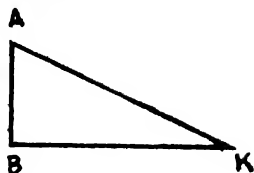
Shna kawei ka \triangle **ABK**. Buh dak **D** hamar shiteng u **BK**. Pyniasoh **AD**. Une u lain u ot ha marshiteng u lain **BK**.

11. Ia u lain ba la ring na ka vertex shapdeng jong u side ba iapyrshah ngi khot u Median.



Shna kawei ka *right-angled* triangle.

12. Ia u side baiapyr-shah ia ka right angle ha ka right-angled triangle ngi khot u Hypotenuse.



JINGPYRSHANG 9.

1. Shna triangle kiba don kine harum :--
 - (a) $AB = 3.5$ cm, $BK = 3.5$ cm, $AK = 3.5$ cm.
 - (b) $AB = 3$ cm, $BK = 5$ cm, $AK = 3$ cm.
 - (k) $a = 4$ cm, $b = 5$ cm, $k = 3$ cm.
 - (d) $k = 4$ cm, $a = 2$ cm, $b = 6$ cm.
2. Kino na kitei ki triangle ki dei ki *equilateral*, *isosceless* bad *scalene* triangle? Kino na ki ki dei ki *acute-angled* \triangle , *right-angled* \triangle bad *obtuse-angled* \triangle ?
3. Thew ia kawei pa kawei ka *angle* kaba don ha ki triangle jong ka jingkylli 1. Adlang baroh lai tylli ki *angle* jong ki triangle. Katno ki long?
4. Shna triangle kiba don kine harum :--
 - (a) $BK = 2''$, $\angle B = 60^\circ$, $\angle K = 40^\circ$
 - (b) $BK = 1.5''$, $\angle B = 90^\circ$, $\angle K = 30^\circ$.
 - (k) $BK = 1.2''$, $\angle B = 120^\circ$, $\angle K = 20^\circ$.
 - (d) $a = 1.4''$, $\angle B = 45^\circ$, $\angle K = 45^\circ$.
 - (c) $a = 1.7''$, $\angle B = 60^\circ$, $\angle K = 60^\circ$.
 - (g) $a = 1.8''$, $\angle B = 90^\circ$, $\angle K = 90^\circ$.
5. Kino na kitei ki triangle ki dei *equilateral* *isosceles* ne *scalene*? Kino pat ki dei ki *acute-angled* \triangle *obtuse-angled* \triangle ne *right-angled* \triangle ? Thew ia ka $\angle A$ ha kawei pa kawei. Adlang ia ki *angle* ha kawei pa kawei ka triangle.

6. Khap ka triangle lai dong da ka kot sada. Khylliap pynkynduh ki khmut *angle* baroh lai ha u lain ba ha trai. Ki *angle* baroh lai ki pynlong *angle* shi lain. Phi ring jingmut aïu nangne? Ki *angle* baroh lai jong ka triangle ki dei ban iaryngkat lang katno?

7. Phi lah ban shna triangle da ki lain, haba ar tylli na kita ki kham lyngkot ia uba lai? Kata kum **BK** = 7 cm, **AB** = 3 cm, **AK** = 2 cm. Ki ar tylli ki lain ki dei ban kham aïu ia uba lai?

KI JINGPYRSHANG KHLEH .A.

1. Kaei ka *solid*, ka *surface*, ka *plane* bad ka *vertex*? Batai ia ka jingmut jong ki bad ring da ki dur de.

2. Kaei ka *circle*? Kiei ki bynta jong ka *circle*? Ring ki dūr bad jer kyrteng ia kawei pa kawei.

3. Ia uwei u lain u babeit la pynskhem na kawei ka tduh jong u. Bad na kawei pat ka tduh jong u la ring pyntawiar ialade. U shna ka dur aïu? ia ka jingjrung jong uta u lain la khot uei? Arshah ka jingjrung jong uta u lain pat la khot uei?

4. Kaei ka jingīapher hapdeng ka *Complement* bad ka *Supplement*? Pynshai da ki dur. Shna ka *angle* kaba 85° , bad ring sa ia ka *complement* bad ka *Supplement* jong ka.

5. Batai kumno ki iapher ki *adjacent angle* na ki *vertically opposite angle*. Ring dur bad jer kyrteng ia la ki jong ki jong ban pynshai ia ka jingmut jong ki.

6. Ar tylli ki lain ki babeit ki iasyrtap thik la ki tduh jong ki. Ia uwei na ki la pied bad la pynkhih tawiar haduh ba un da wan iasyrtap biang na shadien jong uta uwei. Ki angle aũ ba ki shna ? Ai kyrteng ia ki bad batai kawei pa kawei.

7. Ia kiba kumno ki triangle la khot kyrteng ki *equilateral*, *isosceles* bad *scalene* triangle ? Shna ki dur ban pynshai ia kata.

8. Balci ia ki triangle la khot pynpher sha ki *right-angled*, *obtuse-angled* bad *acute-angled* triangle ? U *hypotenuse* u iapher kumno na u median ? Pynshai da ki dur.

9. Kiei ki parallel ? Kumno yn ring ia ar tylli ki lain kiba ialong parallel ?

10. Don lai ngut ki nongsiat khnam. Arngut kiba iashong na ki rud ki siat mar uwei u khnam, bad ki dei baroh ar. Uba shong hapteng u siat ar tylli ki khnam, uwei u leit sha kamon bad uwei sha kadiang jong u skum. Un leh kumno ba un dei kum kita kiwei ?

Kine ki dak ne jingthoh lyngkot harum la ju
pyndonkam ha ka Geometry.

\therefore	ia ka	namarkata.
\therefore	„ „	namar.
$=$	„ „	ia ryngkat
\angle	„ „	angle.
\triangle	„ „	triangle.
\bigcirc	„ „	circle.
Oce	„ „	circumference.
$>$	„ „	kham heh ban.
$<$	„ „	kham rit ban.
m	„ „	metre.
cm	„ „	centimetre.
mm	„ „	millimetre.
s'	„ „	s phut.
s''	„ „	s inshi.
rt	ia ka	right angle.
pt	„ „	u point.
perp	„ „	perpendicular.
isos	„ „	ka isosceles.
st.line	„ „	u straight line.
Parl	„ „	parallel.

BYNTA 11.

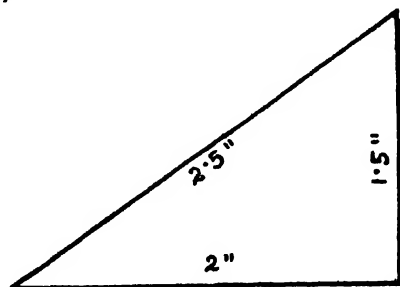
8. KA JINGTHEW DUR DA U SCALE (SKEL).

1. Ka kamra ka don 20 phut ka lynter bad 15 phut ka pyngkiang. Shem da kaba ring dur katno ka jngai na kawei ka kyndong sha kawei pat ka dong kaba iapyrshah.

Ngi pynlong 10
phut ban = 1 inshi.

Kata ia u phut
ngi khot noh
inshi, bad sa dibaid
da u 10.

Kumta ba 20
phut kan long 2"
bad 15 phut = 1.5"



Ngi ring lain da u scale 2" da pyngkiang bad u *perpendicular* 1.5" da pynieng ha tduh u lain. Kata ngi thew ia ka angle ba kan long shi *right angle* lane thik 90°. Ngi pyniasoh da u lain ia ki tduh jong kine ki *perpendicular*. Ngi thew ia u da u scale bad ngi thew u long 2.5". Ngi khot phut ia u bad multiply da u 10. Ka jingjngai namarkata na ka dong sha ka dong ka long 10 shah ki 2.5 phut lane ka long 25 phut

2. Ka jingkieng ka shaniah ha ka kynroh ka bajrong 16 phut, bad ka jngai pat 12 phut na ka kjat

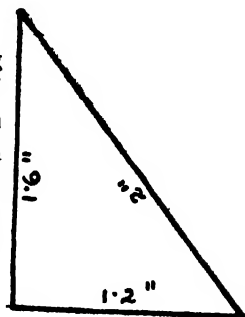
jong ka kynroh. Ring dur, pynlong 10 phut ban = 1 inshi bad shem ia ka jingjrong ka jingkieng.

Namar 10 phut = 1 inshi.

16 phut = 1'6"

bad 12 phut = 1'2".

Ngi ring lain da pyngkiang 1'2 bad u *perpendicular* 1'6" da pynieng ha tduh u lain. Ngi pyniasoh ia ki tduh ban long ka *right-angled triangle*. Ngi thew ia u hypotenuse bad ngi shem u long 2". Kumta ka jingkieng ka jrong $2 \times 10 = 20$ phut.



3. Uwei u briew u mih na Shillong bad leit shatei bad poi ha Nongpoh 35 mail. Uwei pat u briew u mih na Shillong bad leit beit sha mihngi bad poi ha Nartiang 25 mail. Shem katno mail kine arngut ki briew ki iajngai uwei na uwei pat?

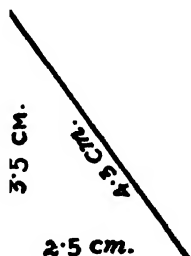
Ngi pynlong 10 mail = 1 cm.

Kumta 35 mail = 3'5 cm.

bad 25 „ = 2'5 cm.

Ngi ring lain 3'5 cm da

pynieng bad na kjat u lain ngi ring *perpendicular* sa uwei 2'5 cm da pyngkiang sha kamon. Ngi pyniasoh ia ki tduh ki lain bad thew ia u lain da u skel. Ngi shem u long 4'3 cm. Kumta ngi ong u jngai 43 mail.



(Ladaki jingthew ki jrong eh ngi pyndonkam da ki 1 cm ha ka jaka 1 inshi).

JINGPYRSHANG 10.

1. Kawei ka kynroh bah ka don 40 phut ka lynter bad 30 phut ka pyngkiang. Shem ïa ka jingjngai na ka kyndong sha kawei pat kaba ïapyrshah.

2. Ka jingkieng ka shaniah ïa ka kynroh kaba 12 phut bad ka jngai 5 phut na kjat ka kynroh. Shem katno ka jingkieng ka jrong ?

3. Ka jingkieng ka don 8 phut ka jingjngai na kjat ka kynroh ïing bad ka kot haduh 15 phut ha ka kynroh. Shem ïa ka jingjrong ka jingkieng.

4. Ka madan ïalehkai ka don 28 kot ka pyngkiang bad 45 kot ka lynter. Shem ïa ka jingjlán na kawei ka dong sha kawei ka dong baïapyrshah.

5. Uwei u briew u leit shuwa 20 mail sha mihngi nangta sa 99 mail shatei. Shem katno u jngai na ka jaka ba u mih lada pom beit kumba siat u khnam.

6. Ha kaba ïeng najrong uwei u lúm, u briew u ïohi ïa u lúm Kyllang ba u don 24 mail sha sepngi bad ïa u lúm Sohpet Bneng ba u don 7 mail shatei. Katno kine ki lúm ki ïajngai uwei na uwei pat ?

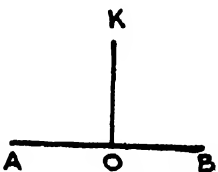
7. Uwei u briew u teh tyllai ha ka riat kaba jrong 112 phut bad u pynjngai 15 phut na kjat ka riat. Katno ka jingjrong une u tyllai ?

KI JINGRING DUR DA KA PROTRACTOR

1. BAN RING RIGHT ANGLE BAD PERPENDICULAR

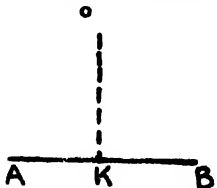
1. Na u point **O** ha u lain **AB** ring *perpendicular* **OK**.

Ngi ring u lain **AB** bad buh u point **O** ha u **AB**. Nangta ngi buh ãa ka *protractor* hamar u lain **AB**, ngi pynhap ãa ka shíteng u lain *protractor* hamar i point **O**. Nangta ngi wad ãa u dak 90° ha ka lyngwiar *protractor*, bad buh dak point **K** hamar hangta. Ngi weng ãa ka *protractor* bad ring lain na u **O** sha uta u point **K**. Te **OK** u long u *perpendicular* ha u **AB**, namar ba ka angle **KOB** $= 90^\circ =$ ka \angle **KOA**.



2. Na u point **O** habar u lain **AB** ring *perpendicular* **OK** ha u **AB**.

Ngi ring lain **AB** bad buh point **O** habar u lain **AB** shaneng u **AB**. Ngi buh ãa u lain *protractor* hamar u lain **AB**. Nangta ngi pyntuid ãa u lain *protractor* ha u lain **AB** haduh ba u lain **O** un háp hamar u lain ba siat ãa u 90° . Nangta ngi buh point **K** ha u **AB** hamar u shiteng jong u lain *protractor*. Ngi weng ãa ka *protractor* bad pyniasoh **OK**. Une u **OK** u long u *perpendicular*. Ka \angle **OKB** ne \angle **OKA** $= 90^\circ$.



JINGPYRSHANG 11.

1. Ha u point **O** ring saw tylli ki *perpendicular* **OA**, **OB**, **OK**, **OD**.

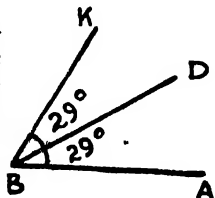
2. Na ki point **X** bad **Y** shaneng u lain **AB** ring ar tylli ki *perpendicular* **XM** bad **YN** ha u **AB**.

3. Ring u lain **PR** u balyngkot bad **AB** harum, u bajrong. Ring *perpendicular* na u point **P** bad **R** ha u lain **AB**.

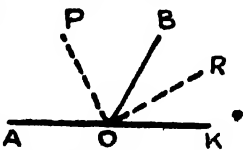
4. Ring ar tylli ki lain **AB**, **KD** kiba iapom ha u point **O**. Ring *perpendicular* na u **K** bad **D** ha u **AB**.

2. BAN PHIAH IA KI ANGLE

1. Shna ka angle **ABK** kaba iaryngkat 58° . Shna pat ka angle **ABD** kaba iaryngkat 29° . Thew ka \angle **DBK** ka long katno? Kumta la phiah ia ka \angle **ABK** da u lain **BD**.



2. Ring u lain **OB** u bam da ieng beit thik ha u lain **AOK**. Pynlong ia ka \angle **KOB** 60° . Mynta thew ia ka \angle **KOR** da ka *protractor* ban long 30° , lane shiteng ia ka \angle **KOB**. Thew pat ia ka \angle **AOP** ban long shiteng ia ka \angle **AOB** (kata $\frac{1}{2}$ ia ka $180^\circ - 60^\circ = 60^\circ$). Thew ka \angle **POR** ka long katno?



Lada adlang ia ka \angle **AOP** + \angle **KOR** ki iaryngkat ne ém bad ki \angle **BOP** + \angle **BOR**.

Ka $\angle AOB + \angle BOK$ ki long katno ?
 Marshiteng ia kita ki angle pat kin long katno ?

JINGPYRSHANG 12.

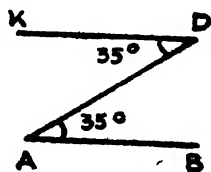
1. Ring u lain **AOK** Pynlong ka $\angle AOB$ 130° . Ka $\angle BOK$ ka long pat katno ? Phiah ia ka $\angle AOB$ da u **OP**. Ka $\angle BOP$ kan long katno ? Phiah ia ka $\angle KOB$ da u **OR**. Ka $\angle POR$ kan long katno ? Shem pat ka $\angle AOP$ bad ka $\angle KOR$ ki ialong katno ?

2. Pynieng pashing ia u lain **OB** ha u lain **AOK**. Bad phiah ia ka $\angle AOB$ bad $\angle BOK$ da u **OP** bad **OR**. Shem ia ka $\angle POR$, haba ka $\angle AOB$ ka long (i) 70° (ii) 90° (iii) 150° ne (iv) 180° .

3. BAN RING LAIN PARALLEL

1. Ring u lain **AB**.
 Shna ka $\angle BAD$ sha kamon kaba 35° .

Shna pat ka $\angle ADK$ sha kadiang katjuh 35° , kat ka $\angle BAD$.



Pynshisha da ka *set square* u **AB** bad **KD** ki iaparallel ne ém ?

Lada kwah ia phi ban ring lain parallel ar tylli da ka jingiarap ka *protractor*, kumno phin leh ?

Ia u lain ba ot ia ki lain ba iaparallel ngi khot u **Transversal**. Kum ia u **AD** ha ka dur haneng.

Ia ki angle ba don sha kamom jong kawei ka tduh jong u transversal bad sha kadiang jong kawei pat ka tduh jong ujuh u transversal ha ki lain ba ñaparallel ngi khot ki **alternate angles**. Kine ki angles ki long ha ka dur **Z**, kum ka \angle **BAD** bad ka \angle **KDA** ha ka dur haneng.

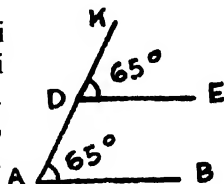
JINGPYRSHANG 13.

Ring lain parallel ar tylli, kumta ba ki *alternate angles* ha u transversal kin long (i) 45° (ii) 75° (iii) 90° bad (iv) 150° .

2. Ring ar tylli ki lain bañaparallel ha kajuha ka liang jong u lain bañakynduh ña ki.

Kawei ka rukom :--

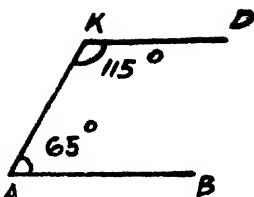
Ngì ring u lain **AB** bad ngi shna kawei ka angle **BAK**, tharai kaba 65° . Buh point **D** ha u **AK**. Nangta ngi shna ka angle **KDE** ha kajuha ka liang u **AK** kaba ñaryngkat ña ka \angle **BAK**, kata 65° .



Ngì sa pynshisha da ka set square la ki ñaparallel ne ém, u **AB** bad u **DE**.

Lane da kumne :—

Ngi ring u lain **AB** bad ngi shna kawei ka \angle **BAK**, tharai 65° . Ha u **K** ngi shna biang ka \angle **AKD** sha kajuha ka liang u **AK** ka angle kaba ñaryngkat ña ki *supplement* jong ka \angle **BAK**, kata kiba ñaryngkat $180 - 65$ lane 115.



Ngi pynshisha da ki *set square* bad ngi shem ba u **AB** bad **KD** ki ña parallel.

JINGPYRSIANG 14.

1. Shna ka angle **BAK** kaba 50° . U point **D** u long ha u **AK**. Ring lain **DE** bad **KG** kiba ña parallel ña u **AB** sha kajuha ka liang u **AK**.

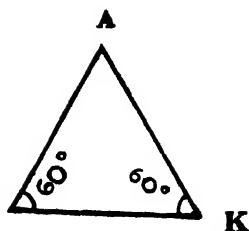
2. Shna ka \angle **BAK** kaba 60° . Ring lain **BD** ban parallel ña u **AK** sha kajuha ka liang

3. Shna ka \angle **BAD** kaba 40° . Ring lain **DK** ban parallel ña u **AB** bad **BK** ban parallel ña u **AD**. Kanc ka dur **ABKD** ka dei ka dur aïu.

†. BAN SHNA TRIANGLE

1 Shna ka triangle **ABK** ha u *base* **BK** uba 1", bad ki angle ha tduh jong u kiba 60° .

Ring u lain **BK** uba 1". Ha u point **B** shna da ka *protractor* ka $\angle \mathbf{KBA}$ kaba 60° . Kumjuh ha u point **K** shna ka angle **BKA** kaba 60° . Ai ba kine ki lain **BA** bad **KA** kin iakynduh ha u point **A**.



Thew ia ka angle **BAK** ka long katno? Nangta thew ia ki lain **AB** bad **AK**, ki ialong mar katno? Ki iaryngkat ne ém bad u **BK**?

Ia kum kane ka triangle ngi khot kaei?

Ia ka *equilateral triangle* lah ban shna ha uno uno u lain da pynlong ki angle kiba iaryngkat barobor 60° .

JINGPYRSHANG 15.

Da ka jingiarap ka *protractor* shna *equilateral triangle* ha u lain :—

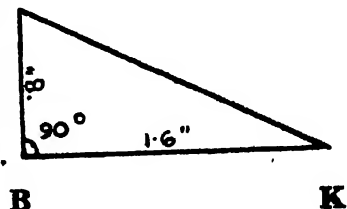
(i) 1.5" (ii) 2.5 cm (iii) 36 mm.

2. Shna ka *right-angled triangle*, ki ar tylli ki lain kiba ker ia ka *right angle* kin long .8" bad 1.6".

Ring u lain **BK** uba 1.6".

Ha u point **B** shna da ka *protractor* ka $\angle \mathbf{KBA}$ kaba 90° .

Pynlong ia u **BA** ban iaryngkat .8". Pyniasoh **AK**. Te ka **ABK** ka long ka *right-angled* \triangle , ha kaba u **BK** = 1.6", u **AB** = .8" bad ka $\angle \mathbf{ABK} = 90^\circ$.



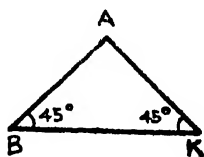
JINGPYRSHANG 16

Da ka jingiarap ka *protractor* shna *right-angled triangle* ar tylli ba ki lain baker'ia ka *right angle* kin long (i) 2" bad 1.5", (ii) 3 cm bad 4 cm (iii) 66 mm bad 50 mm.

3. Shna ka *isosceles triangle* ha u *base* uba 1" bad ki angle ha tduh jong u kin long 45° kawei kawei.

Ring u lain **BK** uba 1".

Ha u point **B** shna da ka *protractor* ka \angle **KBA** kaba 45° . Kumjuh ha u **K** shna ka \angle **BKA** kaba 45° . Ai ki lain **BA** bad **KA** kin ia kynduh ha u point **A**. Te **ABK** ka long *isosceles triangle*. Thew ia u lain **AB** bad **AK**, ki iaryngkat ne ém ?



JINGPYRSHANG 17

Da ka jingiarap ka *protractor* shna *isosceles triangle* kiba don kine harum :— Thew ia ki angle ha khlieh ki long katno ?

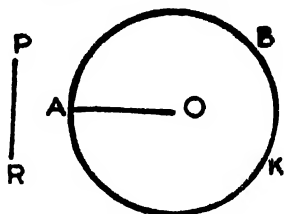
- (i) *base* 1.5", ki angle 36° ha tduh u *base*.
- (ii) *base* 4.2 cm ki angle 72° ha tduh u *base*.
- (iii) *base* 55 mm ki angle 90° ha tduh u *base*.

10. KA JINGRINGDUR DA U COMPASSES

KI CIRCLE

1. Ring ka *circle* **ABK** da u *radius* uba kat u **PR** ha ka *centre* **O**. Ngi buh dak ia u point **O**.

Ngi kad ia u *compasses* bad thew ia ka jingjlán u **PR**. Nangta ngi pynháp ia u khmut nar *compasses* lia u point **O** bad ngi ring ka *circle* **ABK**.



Kumta da ka *centre* **O** bad da u *radius* **PR** ngi ring ka *circle* **ABK**.

JINGPYRSHANG 18

1. Ring *circle* da u *radius* uba (i) 3" (ii) shiteng ia u 3" (iii) shipawa ia u 8 cm.

2. Ring u lain **AB** uba 1.3". Na *centre* **A** bad u *radius* **AB** ring kawei ka *circle*. Na *centre* **B** bad da ujuh u *radius* ring sa kawei ka *circle*. Ki *circle* ki iápom ne ém?

3. Ring u lain **PQ** uba 4 cm. Na *centre* **P** bad u *radius* uba 2 cm ring kawei ka *circle*. Na *centre* **Q** bad ujuh u *radius*, ring biang sa kawei ka *circle*. Ki iákynduh ne ém?

4. Ring u lain **MN** uba 2". Na *centre* **M** bad u *radius* 1.2" ring kawei ka *circle*. Na *centre* **N** bad ujuh u *radius* ring sa kawei ka *circle*. Ki iápom ne ém?

5. Ring u lain **XY** uba 3". Na *centre* **X** bad u *radius* 1" ring kawei ka *circle*. Na *centre* **Y** bad ujuh

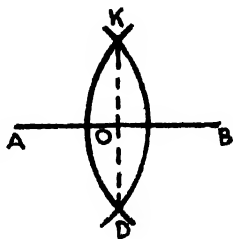
u *radius* ring sa kawei ka *circle*. Ki iapom ne ém ? Yn leh kumno ia u *radius* ba kin iapom ?

2. KI ARC : KABA OT IA U LAIN MARSHITENG

Ring u lain **AB** uba 1.4" bad ot ia u marshiteng da ka jingiarap u *compasses*.

Ring u lain **AB** uba 1.4".

Na centre **A** bad u *radius* uba palat khyndiat marshiteng ia u **AB** ngi ring *arc* ar liang u **AB**. Na centre **B** bad da ujuh u *radius* ngi ring biang sa kawei ka *arc* kumjuh. Kine ki *arc* ki iapom kawei ia kawei. Ngi khot ki point **K** bad **D**.



Pyniasoh **KD** bad un ot ia u **AB** ha i point **O**. Ine i point **O** in long ha marshiteng u **AB**. Thew da u *divider* u **AO** u iaryngkat ne ém bad u **OB** ? Thew pat ia u **AK** bad **AD**, nangta ia u **BK** bad **BD**. Kine ki iaryngkat balei ?

(Ki *radius* jong kajuha ka *circle* ki iaryngkat. Ki *circle* pat da' ujuh u *radius* ki iaryngkat. Haba ki *circle* ki iaryngkat ki *radius* jong ki ki iaryngkat).

JINGPYRSHANG 19

1. Ot marshiteng da ka jingiarap u *compasses* ia ki lain kiba (i) 2.5" (ii) 4.1 cm (iii) 55 mm.

2. Ring u lain **AB** uba 3". Na centre **A** bad u *radius* uba 2" ring *arc* kawei. Na centre **B** bad u *radius* uba 1.2" ring *arc* sa kawei. Pyniasoh da u lain na ki jaka ba ki iapom ban ot ia u **AB** ha u **O**

U **O** u long ha shiteng u **AB** ne ém? Thew bad batai kumno um long? Yn leh kumno ba un dei ha shiteng?

3. Ring u lain **KL** uba 8". Ot ãa u marshiteng da ka jingiarap u *compasses*.

(Ai *radius* uba palat khyndiat ãa u 4").

4. Ring *circle* ha u diameter uba 3'1".

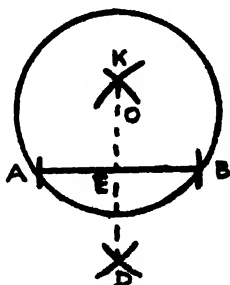
(Ot shuwa ãa u marshiteng sa ring *circle*; ai *centre* na pdeng).

5. Ring *circle* da u diameter 4 cm bad ha kata ka *circle* ring u *chord* uba 3 cm.

3. KI CHORD: KABA OT MARSHITENG IA U CHORD

Ha ka *circle* kaba don u *radius* 5", ring u *chord* 8" bad sa ot ãa u marshiteng da u *compasses*.

Da u *radius* 5" (kata $\frac{1}{2}$ in.) bad ka *centre* **O** ngi ring *circle* kawei. Shim *centre* **A** ha u pud bad da u *radius* uba 8" ring *arc* ban ot ãa ka *circumference* ha u **B**. (Lada shim *centre* na u **B** bad da ujuh u *radius* un ot ãa u pud ha u **A**).



Pyniasoh **AB**.

Une u long u *chord* uba 8".

Na *centre* **A** bad u *radius* palat khyndiat ãa shiteng u **AB** ring *arc* arliang u **AB**. Na *centre* **B** bad ujuh u *radius* ring *arc* biang sa ar tylli ki ban pom ãa kiba mynshuwa ha u **K** bad **D**.

Pyniasoh **KD** bad un ot ãa u **AB** ha u **E**.

Te u **E** un long ha shiteng u **AB**.

Thew ia ka \angle **AEK** bad ka \angle **BEK**. Ki ialong katno? Pynjrong ia u lain **DE**. Un iaïd lyngba ka centre **O** ne ém? U **OE** u long aïu ha u **AB**?

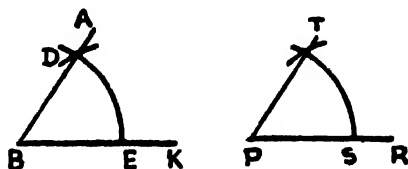
JINGPYRSHANG 20

1. Ot marshiteng (da ka jingïarap u *compasses*) ia u *chord* uba 4 cm ha ka *circle* kaba don u *radius* 3 cm.
2. Ot marshiteng (da ka jingïarap u *compasses*) ia u *chord* uba 1.3" ha ka *circle* kaba don u *diameter* uba 2".
3. Ot marshiteng (da ka jingïarap u *compasses*) ia u *chord* uba 3" ha ka *circle* kaba don u *radius* uba 1.5".
4. Ot marshiteng (da ka jingïarap u *compasses*) ia u *chord* uba 5 cm ha ka *circle* kaba don u *radius* 2 cm.

4. KI ANGLE :

KABA SHNA ANGLE KAT KAWEI BA LA AI

Ring kano kano k1 angle **ABK** kaba hapdeng 90° bad 30° . Shna (da u *compasses*) sa kawei pat ka angle kaba iaryngkat bad kata ka angle **ABK**.



Shna ka angle **ABK** kaba duna ia ka 90°
Shim sa uwei u lain **PR** harud.

Na centre **B** bad u *radius* uba duna ïa u **BA** bad **BK** ring *arc* ban ot ïa u **AB** ha u **D** bad ïa u **BK** ha u **E**.

Na centre **P** bad da u *radius* uba ïaryngkat ïa ujuh u *radius* **BE** ring *arc* ban ot ïa u **PR** ha u **S**. Na centre **S** bad da u *radius* u baïaryngkat bad u **ED** ring *arc* ban ot ïa ka *arc* bamynshuwa ha u **T**.

Pynïasoh **PT**.

Te ka \angle **TPS** kan ïaryngkat bad ka \angle **ABK**.

Thew da ka *protractor*, khmih ka ïabiang ne òm?

Ka jingjingai u **E** na u **B** bad u **S** na u **P** ka long katjuh. Bad ka jingkad jong ka \angle **ABK** bad jong ka \angle **TPS** ka long katjuh, namar ngi thew ryngkat ïa u **TS** bad **DE**.

Lada ngi kwah ban shna kaba 2 shah ngi jám na u **T** sa shisien jám kat u **TS**

Lada kaba 3 shah ngi já n arsien na u **T** ban long arshah ïa u **TS**.

JINGPYRSHANG 21.

1. Shna da ka *protractor* ka angle kaba (i) 45° (ii) 65° (iii) 120° bad (iv) 180° . Shna sa kiwei pat ki angle kiba kattei thik da ka jingïarap u *compasses*.

2. Shna ka angle **ABK** kaba 51° , kaba phai shaphang kamon. Ha u **A** shna pat ka angle kaba katjuh da u *compasses* ha kawei pat ka liang u **AB**.

3. Shna da ka *protractor* ki angle kiba (i) 45° (ii) 90° bad (iii) 180° . Shna sa kiwei pat ki angle kiba arshah thik ïa kitei da ka jingïarap u *compasses*.

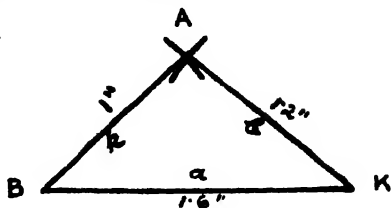
4. Shna da ka *protractor* ki angle (i) 30° (ii) 60° (iii) 120° . Shna sa kiwei pat ki angle kiba lai shah thik ïa kitei da ka jingïarap u *compasses*.

5. KI TRIANGLE : KABA SHNA TRIANGLE

(a) Shna triangle kawei kaba la ker da kine ki lain $AB = 1''$, $AK = 1.2''$, $BK = 1.6''$.

Ring u lain BK uba iaryngkat $1.6''$ da u ruler. Na centre B bad di u radius uba $1''$ ring arc shaneng u BK . Na centre K bad d.

u radius $1.2''$ ring arc biang shaneng u BK ban iapom ha u point A .



Pyniasoh AB , AK .

Te ABK ka long ka triangle.

$AB = 1''$, $AK = 1.2''$ bad $BK = 1.6''$.

la u lain BK bapyrshah ia ka $\angle A$ la thoh a.

„ „ „ AK „ „ „ $\angle B$ „ „ b.

„ „ „ AB „ „ „ $\angle K$ „ „ k.

Shuwa ban shna dur, bha ba shu ring lypa malu mala da ka kti harud.

JINGPYRSIANG 22.

Shna triangle kiba don kine harum :—

Ki dei ki triangle aü kine ba phi shna ?

(i) $a = 1''$, $b = 1''$, $k = 1''$.

(ii) $a = 2''$, $b = 1.5''$, $k = 1.5''$.

(iii) $a = 5\text{cm}$, $b = 4\text{cm}$, $k = 3\text{cm}$.

(iv) $a = 2''$, $b = 3\text{cm}$, $k = 45\text{mm}$.

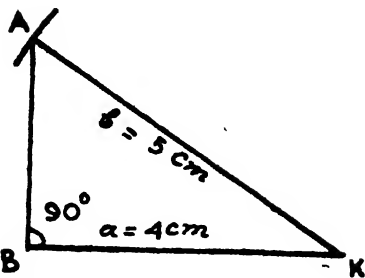
(v) $a = 3''$, $b = 4\text{cm}$, $k = 35\text{mm}$.

(b) Shna kawei ka *right-angled triangle* kaba don kine harum :—

$a=4\text{cm}$, $b=5\text{cm}$,
 $\angle B 90^\circ$.

Ring u lain **BK** uba 4cm.

Na centre **K** bad radius uba 5cm ring arc shaneng u **BK** mar-pyrshah ia u **B**. Ha u **B** ring perpendicular **AB** ban iakynduh ia ka arc ha u **A**.



Pyniasoh **AK**.

Te ka **ABK** ka long ka *right-angled triangle*.

BK=4cm, **AK**=5cm bad ka $\angle B=90^\circ$.

Lada **AB** ka long ka kynroh iing, **AK** ka long ka jingkieng, ka jingjngai na trai ka kynroh ha kjat ka jingkieng ka long u lain **BK**.

Kumta lada ai ia ka jingjrong u **BK** bad u **AK** lane **AB** bad **AK** ngi lah ban ring ia ka dur haneng, bad thew ia uta u lain uba ngim tip.

JINGPYRSHANG 23.

1. Ka jingkieng ka jngai 9 phut na trai ka kynroh bad ka kot 12 phut ha ka kynroh. Shem ia ka jingjrong ka jingkieng. Pynlong 3 phut=1 cm.

2. Ka jingkieng ka jngai 5 phut na trai ka kynroh bad ka jrong 13 phut. Shem ia ka jingjrong ka kynroh ba ka kot.

3. Arngut ki briew ki iamih lang na kajuha ka jaka. Uwei u leit 4 mail beiti shatei, uwei pat

u leit beit sha mihngi. Ka jingjingai hapdeng kita ki briew ka long 5 mail. Katno mail uta uba leit sha mihngi u ñaid ?

4. Uwei u briew u ñaid 40 mail sha sepngi, nangta beit sa shatei bad u shem ba u jngai 50 mail na ka jaka ba u mih. Katno mail u la ñaid shaphang shatei ?

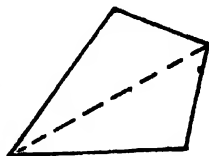
5. U Stet u mih na ka shnong **A** bad leit 40 mail beit sha mihngi bad poi ha ka shnong **B**. U Sting pat u mih na ka shnong **B** bad u leit 40 mail beit sha sepngi. Shem katno u Sting u jngai na ka shnong **A** ?

7. KI QUADRILATERAL

Shim saw tylli ki point, 3 tylli na ki kin ym ñalong ha ujuh u lain. Pynñasoh ña kita ki point da ki saw tylli ki lain. Ia kane ka dur ba la ker da ki saw tylli ki lain la khot ka *quadrilateral*.

Shna kano kano ka dur ba la ker da ki saw tylli ki lain. Kane ka dur ruh ka long ka *quadrilateral*.

1. Ka Quadrilateral ka long kano kano ka dur ba ha sla ba la ker da ki saw tylli ki lain.



Ka *quadrilateral* ka don bún rukom ki dur.



2. Haba ki lain baīapyrshah jong ka quadrilateral ki ialong parallel, ngi khot ia ka ka parallelogram.

3. Lada ha ka parallelogram kawei na ki angle ka long noh ka right angle, ngi khot ia ka ka rectangle.

Ngin sa iohi hadien pat ba ki angle ha ka *rectangle* ki long baroh ki *right angle*

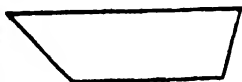
4. Lada ha ka rectangle ar tylli ki lain baīamarjan ki iaryngkat noh ngi khot ia ka ka square.

Ngin sa iohi hadien ba ki lain ki baker ia ka *square* baroh saw tylli ki iaryngkat.

5. Iada ha ka paralellogram ar tylli ki lain baīamarjan ki iaryngkat, hynrei ym don right angle, ngi khot ia ka ka rhombus (rombos).

Ngin sa iohi hadien ba ki lain ki baker jong ka *rhombus* ki iaryngkat lut baroh.

6. Haba tang ar tylli ki lain baīapyrshah jong ka quadrilateral ki iaparallel, kiwei pat kim iaparallel, ngi khot ia ka ka Trapezium.



7. U lain ba pyniasoh ia ki ar tylli ki tduh baīapyrshah jong kano kano ka quadrilateral u long u diagonal.

JINGPYRSHANG 24.

(Pyndonkam da ki set square haba ring ki lain kiba parallel).

1. Ring lain **AB** bad **KD** kiba iäparallel bad baiaryngkat. Pyniasoh iä ki tduh jong ki sha kajuh ka liang ban long ka dur kaba saw tylli ki lain. Thew iä ki lain ba phi pyniasoh, ki iäaryngkat ne ém ? Phi khot ka dur aïu iä kane ?

2. Shna ka *right angle* **ABK**. Pynlong iä u **AB** 1" bad iä u **BK** 2". Ring lain parallel iä u **BK** lyngba u **A**, bad iä u **AB** lyngba iä u **K** ba kin iäkynduh ha u **D**. Phi khot kyrteng aïu iä kane ka dur **ABKD** ?

3. Shna ka *right angle* **ABK**. Pynlong iä u **AB** 1" bad **BK** ruh 1". Ring lain parallel lyngba u **A** bad **K** ban iäkynduh ha u **D**. Kane ka **ABKD** ka dei ka dur aïu ?

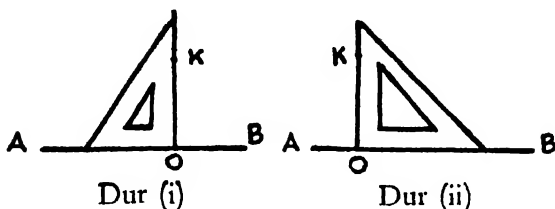
4. Shna ka \angle **PRS** kaba 60° . Pynlong iä u **PR** bad **RS** 3 cm. Ring lain parallel lyngba u **P** bad u **S** ban iäkynduh ha u **T**. Kane ka dur **PRST** ka dei ka dur aïu ?

5. Ring ar tylli ki lain **LM** bad **ON** kiba iäparallel, hynrei ki bam iäaryngkat. Pyniasoh iä ki tduh jong ki ban long ka dur kaba saw tylli ki lain. Phi khot kyrteng ka dur aïu iä kane ka dur **LMNO** ? Pyniasoh pat **LN** bad **MO**. Phi khot kyrteng kiei iä kine ki lain baiapom pyrshah ?

21. KI JINGRINGDUR DA KI SET SQUARE.

1. KI PERPENDICULAR.

(a) Ha u point **O** uba ha u lain **AB** ring *perpendicular OK*.

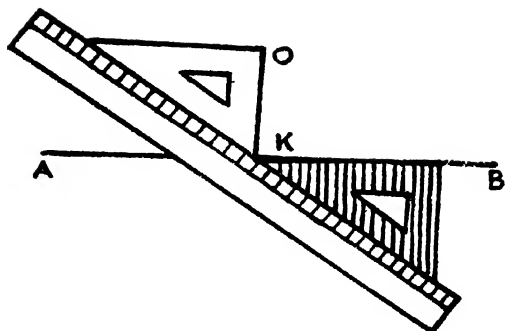


Ring u lain **AB** uba beiti. Bad ngi buh dak **O** ha u **AB**. Ngì shim kawei na ki *set square* bad pynieng *perpendicular* ha u **AB**, kumta ba kawei ka dong ba lyngkot jong ka *set square* kan háp thik ha u **AO**, kum ha ka dur. Ngì pynháp ãa ki khmut dong ka *set square* hamar rud i point **O**, kat ban ïohi bad pynháp ka khmut let. Nangta ngi ring lain **OK**. Une u **OK** u long *perpendicular* ha u **AB**.

(b) Na u point **O** uba shabar u lain **AB** ring *perpendicular OK* ha u **AB**.

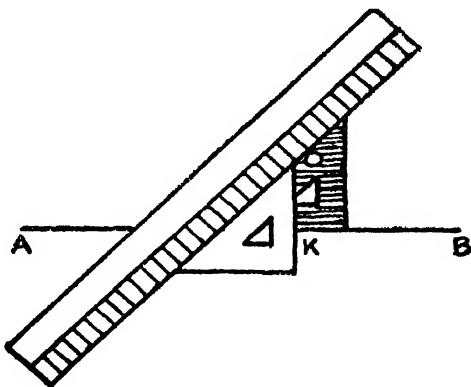
Ring u lain **AB** bad buh dak **O** habar u lain. Pynháp ãa ka dong bajrong jong ka *set square* hamar u **AB** sharum da pynnoh khongpong ãa ka *set square* kum ha ka dur. Kata, pynieng *perpendicular* ãa ka *set square* ha u **AB** da khongpong.

Pyniashem sa ãa u *ruler* pat ha ka liang bajrong jong ka *set square*. Sa pynsyntuid ãa ka *set square* shaneng ha u *ruler* haduh ba ka dong



babeit kan háp thik hamar rud u point **O** kat ban íohi bad ban pynháp ka khmut let ha u. Sa ring lain **OK** ha u **AB**. U **OK** u long u *perpendicular* ha u **AB**.

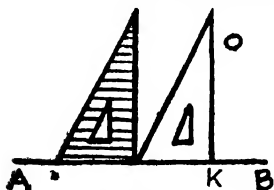
KA BUIT
KA BAAR



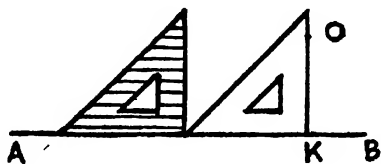
Ring u lain **AB** u babeit. Buh dak **O** habar u lain **AB**. Pynieng *perpendicular* ía ka set *square* ha u **AB** shaneng kum ha ka dur, bad ai kan tap ía u point **O**.

Pyniashem ïa u *ruler* ha ka dong bajrong jong ka *set square*. Pynsyntuid arsut ïa ka *set square* baroh shilynter u *ruler* haduh un da paw u dak **O**, bad un long lain bad ka *set square*. Ring u lain **OK** narud ka *set square* ha u lain **AB**. U **OK** un long u *perpendicular*.

KA BUIT KA BALAI



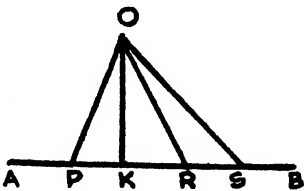
Dur (i)



Dur (ii)

Ring u lain **AB** u babeit. Buh dak **O** habar u lain **AB**. Pynieng *perpendicular* ïa ka *set square* ha u **AB** shaneng kum ha ka dur bad wat tap ïa u point **O**. Pynsyntuid ïa ka *set square* ha u lain **AB** haduh ba kan da ïeng bad u **O**. Sa ring u lain **OK** narud ka *set square* ha u lain **AB**. U **OK** un long u *perpendicular*.

(k) Ring u lain **AB** u babeit. Na u point **O** ba habar u lain ring *perpendicular* **OK** (da ki *set square*) ha u **AB**. Thew ryngkat **KP** bad **KR** (da u *divider*) ha u lain **AB** bad pyniasoh **OP** bad **OR**.



Thew ïa ka jingjrong ïa u **OK**, **OP** bad **OR**. Nangta thew **KS** kham jrong ïa u **KR** ba ha u **AB**.

Pyniasoh **OS**.

Na kine ki lain **OP, OK, OR, OS**, lyngkot eh uno? Ki khot uei ia uta u lain? Kino na kita ar tylli ki baiaryngkat? Ka jingjingai ka trai jong ki na u **K** ka iaryngkat ne ém? Uno u lain u bajrong tam? Uno u lain uba don jngai eh ka kjat na u **K**?

JINGPYRSHANG 25.

1. Ha u lain **AB** ring ar tylli ki *perpendicular* ha u **A** bad u **B**.

2. Ha u lain **AB** uba 1" ring *perpendicular* **KA** bad **DB** kiba 1". Nangta ring *perpendicular* ha u **K** ban ot ia u **BD**.

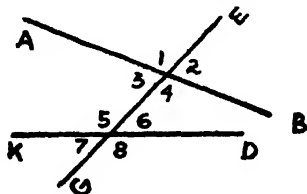
3. Ar tylli ki lain **AB** bad **KD** ki iapom ha u **O**. Ring *perpendicular* na u **K** bad **D** ha u **AB**.

4. Shna kano kano ka \triangle **ABK**. Ring *perpendicular* na u **A, B** bad **K** ha ki lain baiapyrshah.

2. KI PARALLEL.

(a) Ring lain ar tylli **AB** bad **KD** ki bam ialong parallel bad sa ring pat u lain **EG** u ban pom ia ki baroh ar.

Khmih nuksa kum ha ka dur harum :—



Na ka jingiapom kitei ki lain mih 8 tylli ki angle. Ki angle 1, 2, 7 bad 8 ki long shabar. Ngi khot ia ki ki **Exterior angle**. Ki angle 3, 4, 5, bad 6 ki long hapoh kut. Ngi khot ia ki ki **Interior angle**. Ia ki angle 3 bad 6, lane 4 bad 5 ki ialong ha ka dur **Z** ne **S**, ngi khot ia ki ki **Alternate angle**

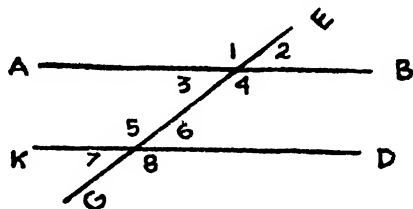
Exterior la shu thoh lyngkot *ext.*

Interior „ „ „ „ *int.*

Alternate „ „ „ „ *alt.*

(b) Ring lain parallel ar tylli **AB** bad **KD**. Ring sa u lain **EG** ban iapom ia ki. Thew ki angle aüu kiba iaryngkat ?

Khmiñ nuksa ha ka dur harum :—



Thew ki angle 2, 3, 6, bad 7. Shem ki iaryngkat ne ém ? Thew pat ia ki angle 1, 4, 5 bad 8. Kine de ki iaryngkat ne ém ?

(i) Phin iohi nangtei ba ha ki lain baiaparallel ki *alternate angle* barobor ki iaryngkat.

Ka $\angle 3 = \angle 6$, ka $\angle 4 = \angle 5$.

Lada ka $\angle 3 = 45^\circ$, shem katno ki angle 2, 6 bad 7 ki long ?

Shem pat katno ki $\angle 1, 4, 5$ bad 8 ki long ?

Kynmaw ba ki angle baiapyrshah ki khmut ki iaryngkat barobor.

Kynmaw ruh ba ki angle ba ialong supplement ki ialong lang barobor 180° .

(ii) Da kaba thew bad khein shem —

Ka *ext* $\angle 2 =$ ka *int* $\angle 6$.

Ka *ext* $\angle 1 =$ ka *int* $\angle 5$.

Ka *ext* $\angle 7 =$ ka *int* $\angle 3$.

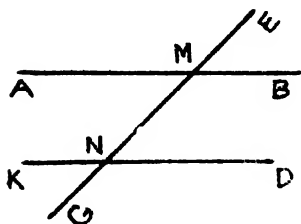
Ka *ext* $\angle 8 =$ ka *int* $\angle 4$.

(iii) Thew bad shem ruh ba —

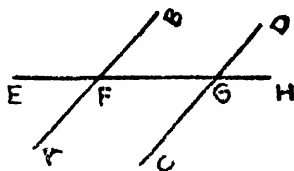
Ka *int* $\angle 4 +$ ka *int* $\angle 6$ sha kamon jong u **EG** $= 180^\circ$ lane 2 rt \angle . Bad ka *int* $\angle 3 +$ ka *int* $\angle 5$ sha kajuha ka liang jong u **EG** $= 2$ rt \angle .

Kata, ki 2 tylli ki interior angle sha kajuha ka liang jong u *transversal* ki ialong barobor 2 *right angle*.

Ha ki dur (i) bad (ii) ai kyrteng ia kine harum :--



Dur (i)



Dur (ii)

- (a) Ki *Alternate angle* kiba iaryngkat.
- (b) Ki *Exterior angle* kiba iaryngkat ia ki *Interior angle*.
- (k) Ki *Interior angle* kiba iaryngkat lang 2 *right angle*.

JINGPYRSHANG 26.

1. Lyngba u point **O** ring lain uwei ban iaparallel ia u lain **AB**. Batai kumno phin leh ?

2. Ring kham pynthiah ia u lain **EG** da pynieng. Pynsyndait ia ka dong bajrong jong kawei na ki *set square* bad ha uta u lain da kawei pat ring lain **AB** bad **KD** kiba iaparallel ban iakynduh ha u **EG**, ha ki point **A** haneng bad **K** harum.

(i) Ka \angle **EAB** ka iaryngkat ia ka \angle aïu ?

(ii) Ka \angle **BAK** bad **AKD** ki iaryngkat lang katno ?

3. Ring kham pynthiah ia u lain **EF** da pynieng. Buh dak **A** haneng bad **K** harum hamar u lain **EF**. Ring lain **AB** bad **KD** kiba iaparallel uwei ia uwei pat ba kumta ki iakynduh ia u **EF** ha u **A** bad u **K**.

Lada ka \angle **BAK** = 120° , katno ki heh ki angle kawei pa kawei ?

4. Ring lain parallel ar tylli **AB** bad **KD** da ki *set square*. Ring sa u lain **EG** ban pom ia ki ha ki point **P** bad **R**. Thoh 1, 2, 3, 4, 5, 6, 7, 8 ia ki angle ha kiba ki iapom.

(i) Ai kirteng ia ki *alternate angle*.

(ii) Ai kirteng ia ki *exterior angle*.

(iii) Ai kirteng ia ki *interior angle*.

5. Ring lain parallel ar tylli **XY** bad **ZW** da ki *set square*. Ring lain pyniapom da u **AB** ban ot ha ki point **P** bad **Q**, kumta ba kawei ka angle kan long 45° .

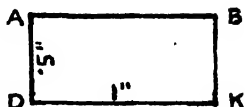
(i) Ki khot aïu ia u lain **AB** ?

(ii) Wad ia ka jingheh kawei pa kawei ka angle ha ki point **P** bad **Q**.

3. KI PARALLELOGRAM.

(a) Shna *rectangle* ha ki lain kiba 1" bad .5".

Ring lain **DK** uba 1". Ha u **D** ring *perpendicular* **AD** uba .5", pynlong ka \angle **ADK** ka *right angle* (da ki *set square* lane *protractor*).



Ha u **A** ring u lain **AB** ban parallel ia u **DK** (da ki *set square*).

Ha u **K** ring lain **KB** ban parallel ia u **AD** (kumjuh da ki *set square*).

Kane ka dur **ABKD** ka long ka *rectangle*.

Mynta thew ia ki lain **AD** bad **BK**. Ki ialong mar katno? Thew par ia ki lain **AB** bad **DK**, ki ialong mar katno?

Thew pat ia ki \angle **DAB**, **ABK**, **BKD**. Ki ialong mar katno?

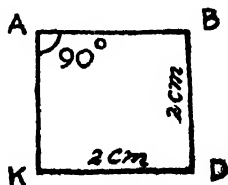
Phin iohi ba baroh ki angle jong ka *rectangle* ki ialong *right angle*. Kata, kawei pa kawei na ki angle jong ka ki iaryngkat 90° .

Ki lain para baiapyrshah jong ka *rectangle* ruh ki iaryngkat.

Ia u lain ba pyniasoh na u **A** sha u **K** ne na u **B**, sha u **D** ngi khot u **Diagonal**.

(b) Shna *square* ha u lain 2cm.

Ring lain **AB** uwei uba 2cm. Ring sa u lain **AK** ban ieng *perpendicular* ha u **AB** kumta ba ka \angle **BAK** kan long 90° . Pynlong ia u **AK** ban long 2cm kum u **AB**.



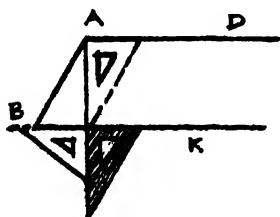
Na u **K** ring lain **KD** ban long parallel ia u **AB** bad na u **B** ring lain **BD** ban long parallel ia u **AK**. Ai kin iakynduh ha u **D**.

Te ka dur **ABDK** ka long ka *square*.

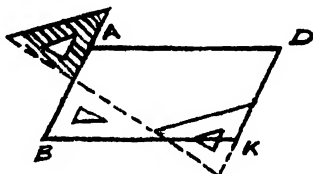
Thew ia ki lain **AB**, **BD**, **DK** bad **KA**. Ki ialong mar katno? Thew pat ia ki \angle **A**, **B**, **D**, bad **K**.

Ha ka *square* ki lain jong ka ki iaryngkat baroh, ki angle jong ka baroh ruh ki long ki *right angle*.

(k) Shna parallelogram ha ki lain kiba "5" bad "1".



Dur (i)



Dur (ii)

Ring u lain **BK** uba "1".

Shna kawei ka \angle **ABK**, ka bam long ka *right angle*. Hangne ngi pynlong 60° . Pynlong ia u **BK** "1" bad ia u **AB** "5". Lyngba u **A** (da ki *set square*) ring lain ban parallel ia u **BK**. Lyngba u **K** ring lain **KD** ban parallel ia u **AB**. Bad un iakynduh ia uba mynshuwa ha u **D**.

Te ka dur **ABKD** ka long parallelogram.

Thew da u *ruler* ne *divider* ki lain ba iapyrshah, u **AB** bad **KD** ki ialong kumno? U **AD** pat bad u **BK** ki ialong kumno?

Thew pat ia ki angle baäpyrshah. Ka \angle **DAB** bad ka \angle **BKD** ki ialong mar katno? Ka \angle **D** bad ka \angle **B** para baäpyrshah ki ialong mar katno?

Nangtei ngi iohi ba ki lain baäpyrshah jong ka parallelogram ki iaryngkat barobor. Ki angle baäpyrshah jong ka parallelogram ruh ki iaryngkat.

(i) **AB=DK** bad **AD=BK**.

(ii) ka \angle **ABK** = \angle **ADK**,
 \angle **BAD** = ka \angle **BKD**.

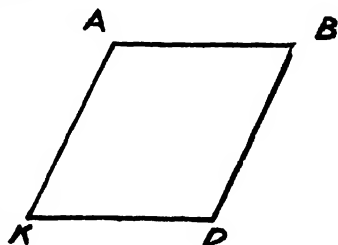
Da kymnaw bha ia kane!

(d) Shna ka *rhombus* ha u lain uba 1".

Ring u lain **AB** uba 1".

Shna ka \angle **BAK** ka tam long *right angle*.

Pynlong ia u **AB** bad **AK** mar iaryngkat



Ha ka *centre* **K** bad da u *radius* kat u **AB**, ring *arc* kawei.

Bad ha ka *centre* **B** bad da u *radius* kat u **AK** ring *arc* sa kawei bad kan iakynduh ia kaba mynshuwa ha u **D**. Pyniasoh **BD**, **KD**.

Te ka **ABDK** ka long ka *rhombus*.

Thew ia ki lain baroh ki iaryngkat ne ém?

\therefore **AB=BD=DK=KA**.

Thew pat ia ki angle baroh. Tang ki angle baäpyrshah ki long kumno?

Kumta ka *rhombus* ka long kum ka *square*, hynrei ki angle jong ka kim long *right angle*, ba kumta kum iaryngkat lut baroh.

Ka jingīapher ka *rhombus* na ka *square*—
 Ka *square* ka iaryngkat lut ha ki *ide* bad ki ang'e
 Ka *rhombus* ka iaryngkat lut tang ha ki *side*, hynrei
 ym ha ki angle.

JINGPYRSHANG 27

(Shuwa ban ring du, bathikna, ring dur i bamalu mala harud).

1. Ring dur *rectangle* **ABKD**, ka \angle **ABK** = 90° , u **AB** = 1'2" bad u **BK** = 8".

Thew ia ki angle kawei pa kawei, bad katno ki long? Thew ia ki lain **AD** bad **DK**. Ki iaryngkat bad kino?

2. Ring dur *square* **ABKD** ha u **AB** uba 3cm.

3. Kawei ka kamra ka don ka lynter kaba 20 pruh bad ka pyngkiang kaba 15 pruh. Ring dur pynlong 10 pruh = 1". Shem ia ka jingjngai na ka dong sha ka dong. Phi khot uei ia u lain bapynia-soh?

4. Kawei ka madan phutbol ka don 160 kot la 120 kot. Ring dur pynlong 120 kot = 3cm. Shem katno jngai na kawei ka dong sha kawei ka dong?

5. Kawei ka erodrom (ka jaka hiar eroplén) ka jrong shi mail shiliang shiliang. Ring dur pynlong shi mail shi inshi bad shem ia ka jingjrong u diagonal.

6. Ring dur parallelogram **ABKD** kaba don kine harum :—

AB = 2", **AD** = 1'5" bad ka \angle **A** = 60° .

Thew ia ki lain **DK** bad **BK**, ki long katno?

Thew ia ki angle **ABK**, **BKD**, **KDA**. Ka \angle **B** ka iaryngkat ia ka angle aïu? Ka \angle **A** pat ia ka angle aïu?

7. Ring dur parallelogram **ABKD**, kaba u **AD** = 3'3cm, **DK** = 5'6cm bad ka $\angle \text{ADK} = 120^\circ$.

Thew ia ki lain baŋapyrshah bad ia ki angle baŋapyrshah. Ki ialong mar katno ?

8. Ring dur rhombus **ABKD** ba u **AB** = 3'5cm bad ka $\angle \text{ABK} = 47^\circ$.

9. Ring dur trapezium **ABKD**, **AB** = 7cm, **AD** = 3cm, **DK** = 5cm. Ka $\angle \text{ADK} = 120^\circ$.

10. Ring dur quadrilateral **ABKD**, **DK** = 2", **AD** = 1" = **BK**. Ka $\angle \text{ADK} = \angle \text{DKB} = 60^\circ$.

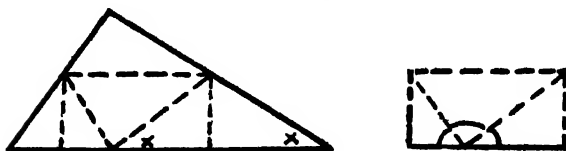
13. KA JINGHEH KI ANGLE

1. HA KA TRIANGLE

(a) Ki angle jong ka triangle ki don katno degree ne *right angle* baroh.



Dur (i)



Dur (ii)

Khap ïa kawei ka kot sada pynlong lai dong kum ka triangle. Khyllïap ïa ki dong jong ka baroh lai bad pynwan ïa ki tduh thik hamar u lain ba ha trai.

Phin shem ba ki dong jong kita ki tduh baroh lai ki ïalong lain lang ha uwei u lain ba ha trai. Kane ka pyni ba ki angle baroh lai jong ka \triangle ki ïaryngkat lang ar *right angle* lane 180° .

Lane kumne :—Shna triangle kano kano kawei, ong **ABK**. Thew da ka *protractor* ïa ki angle kawei pa kawei bad adlang ïa ki baroh lai. Kin ïaryngkat lang katno baroh ?

Kumta ngi rai ba ki lai tylli ki angle jong ka triangle ki ïaryngkat lang ar *right angle* lane 180° .

JINGPYRSHANG 28.

Shna triangle kiba don kine harum bad thew ïa ka jingheh jong ki angle baroh lai :—

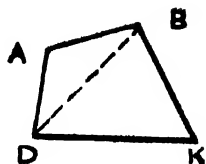
- (a) $a=2''$, $b=1.3''$, $k=1.7''$.
- (b) $\angle B=90^\circ$, $a=4\text{cm}$, $k=3\text{cm}$.
- (k) $\angle B=90^\circ$, $a=3\text{cm}$, $k=3\text{cm}$.
- (d) $a=1''$, $b=1''$, $k=1''$.
- (e) $\angle A=36^\circ$, $b=2.5\text{cm}$, $k=2.5\text{cm}$
- (g) $a=3''$, $b=3\text{cm}$, $k=4.4\text{cm}$.
- (ng) $\angle B=90^\circ$, $a=2.7''$, $k=90^\circ$.

2 HA KA QUADRILATERAL

Ki angle jong ka *quadrilateral* ki heh lang baroh katno degree lane katno *right angle*.

(i) Shna ka *quadrilateral* **ABKD**.

Thew ki angle kawei pa kawei bad thoh ki long katno ? Adlang ia ki baroh saw bad shem katno ki long baroh,



Lanc kumne:--

(ii) Shna kano hano ka *quadrilateral* **ABKD**.

Pyniasoh **BD**.

Ngi tip na kaba mynshuwa ba ki lai tylli ki angle jong kano kano ka triangle ki iaryngkat lang 2 *right angle*, lane 180° .

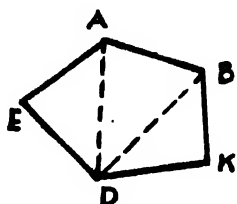
Kumta ki 6 tylli ki angle jong ki 2 tylli ki triangle ki iaryngkat lang 2 rt. $\angle \times 2 = 4$ rt. \angle lane 360° .

Kumta ki angle baroh hapoh ka *quadrilateral* = 4 rt. \angle ne 360° .

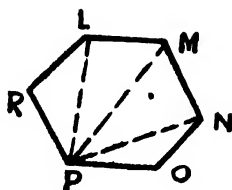
3. HA KI POLYGON

(a) Katno degree ne *right angle* ki don ki angle jong ka—

(i) dur ba k r da ki san lain ? (ii) dur ba k r da ki 6 lain ?



Dur (i)



Dur (ii)

Ring ki dur **san** lain **ABKDE**, bad **hynriew** lain **LMNOPR**. Ha ka dur (i) pyn asoh **AD**, **BD** bad ha ka dur (ii) pyn asoh **LP**, **MP**, **NP**.

Ha ka dur (i) mih 3 tylli ki triangle bad ha ka dur (ii) mih 4 tylli ki triangle.

Kumta ha ka dur (i) don 2 rt. $\angle \times 3 = 6$ rt. \angle lane 540° .

Bad ha ka dur (ii) don 2 rt. $\angle \times 4 = 8$ rt. \angle lane 720° .

Thew  a ki angle da ka *protractor* bad pynshisha ba ka long kumta.

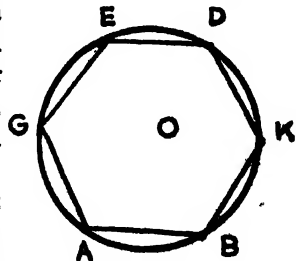
Ia ka dur ba la ker da palat ki saw tylli ki lain la khot ka Polygon

Ia ka Polygon	5	lain la khot ka	<i>Pentagon.</i>
„ „ „	6	„ „ „	„ <i>Hexagon.</i>
„ „ „	7	„ „ „	„ <i>Heptagon.</i>
„ „ „	8	„ „ „	„ <i>Octagon.</i>
„ „ „	10	„ „ „	„ <i>Decagon.</i>
„ „ „	12	„ „ „	„ <i>Dodecagon.</i>
„ „ „	15	„ „ „	„ <i>Quindecagon.</i>

(b) Ring dur ãa ka *Hexagon* kaba ãaryngkat lut ki lain jong ka baroh.

Fa Buit Ka Banyngkong

Ring kawei ka *circle*. Da uta hi u *radius* bad ka *centre* ha u pud jong ka *circumference* ot *arc* ia ka *circumference*. Nangta da ujuh u *radius* bad da ka *centre* ha ki jaka ba ki *arc* ki ot ãa ka *circumference*, ring *arc* biang ter ter baroh sawdong ãa ka *circumference*. Pynãasoh lain na ki jaka ba ot ha ka *circumference*. Kane ka dur kan long ka *Hexagon* kaba don ki lain baroh hynriew tylli kiba ãaryngkat.



Ka Buit Ka Paar.

Shim uno uno u lain **AB**, tharai, uba 1". Nangta shna ka \angle **ABK**, **BKD**, **KDE**, **DEG**, **EGA** bad **GAB** pyllun sawdong kiba 120° kawei kawei, bad pyniaryngkat ia ki lain baroh kat u **AB**.

Ka Buit Ka Balai.

Shna ka *equilateral* \triangle **AOB** ha u lain **AB**, tharai, uba 1". Ha u point **O** shna ka angle baroh sawdong u **O**, **BOK**, **KOD**, **DOE**, **EOG**, **GOA** kiba 60° kawei kawei. Bad pynlong ki lain baroh kin long katjuh kat u **AB**. Sa pyniasoh **BK**, **KD**, **DE**, **EG**, **GA**.

Kata, shna ki *equilateral* \triangle kiba iaryngkat baroh sawdong u **O**, da pynlong **O** kum ka *vertex* jong kita ki *equilateral* \triangle baroh.

Kane ka dur kan long ka *Hexagon*.

JINGPYRSHANG 29.

1. Ka triangle **ABK** ka long ka *right-angled* \triangle ha kaba ka angle **B** $= 90^\circ$. Shem katno ki iaheh lang ki \angle **A** bad **K**?

2. Ka triangle **ABK** ka don kawei ka angle **B** kaba iaryngkat lang ia ki ar tylli ki \angle **A** bad **K**. Katno ka heh ka \angle **B**?

3. Ka \angle **K** ka iaryngkat ia baroh ar ki angle **B** bad **A** jong ka \triangle **ABK**. Pyni ba u **AK** u long u *perpendicular* ha u **BK**.

4. Ha kawei ka *right-angled* triangle kawei na ki angle ka long 45° . Shem sa ia kawei pat katno ka heh?

5. Ha kawei ka triangle ar tylli ki angle ki long 100° bad 30° . Shem ia ka angle ka balai ?

6. Ha kawei ka triangle baroh lai tylli ki angle ki iaryngkat kawei ia kawei. Katno kawei kawei ka long ?

7. Ha kawei ka triangle baroh lai tylli ki lain bakér ia ka ki iaryngkat uwei ia uwei. Shem katno ka jingheh jong kawei pa kawei ka angle ?

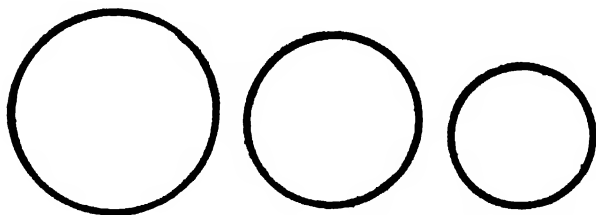
8. Ha ka $\triangle ABK$ ka $\angle A$ ka long 60° . Shem katno pat ki $\angle B$ bad K ki long baroh ar.

9. Ha ka $\triangle ABK$ ia u BK la pynjriong sha u D . Ka $\angle AKB = 50^\circ$. Katno ka $\angle AKD$ ka long ? Katno ka $\angle ABK$ bad $\angle BAK$ ki ialong baroh ar ?

10. Ha ka $\triangle ABK$ ia u BK la pynjriong sha u D . La shem ba ka $\angle A = 90^\circ$ bad ka $\angle AKD = 150^\circ$. Shem ia ka jingheh ka $\angle ABK$ bad ka $\angle AKB$.

14. KA JINGTHEW HA KI CIRCLE

A. Kumno ban shem ia ka jingjlan ka circum'ference jong ka circle haba la shem ia u radius.



Ka tyngka

ka shipiah

ka shisuka

3.5 "

7.5 cm

5.7 cm

Shim kawei ka tyngka, ka shipiah bad ka shisuka.

Buh dak ha ka rymmiang ka tyngka. Ring lain babeit uwei, bad pyntyllun ia ka ha uta u lain shisien tyllun thik. Buh dak katno inshi ka tyllun bad thew ia uta u lain. Un long kumba 3.5". Buh ia ka tyngka ha ka kot sada. Thew ia ka jingjlán u diameter na shiliang ha shiliang un long kumba 1.1".

Leh kumjuh ia ka shipiah bad ka shisuka.

Kan long kumba katne harum : —

Tyngka	diameter	circumference
Tyngka	1.1	3.5".
Shipiah	2.4 cm	7.5 cm.
Shisuka	1.8 cm	5.7 cm.

Da kaba leh kumne bad kiba bún kiwei ki *circle* kiba heh, shem ba ka *circumference* ka long $\frac{22}{7}$ shah (antad) ia u diameter.

Kumta ka *circumference* jong ka—

$$\text{tyngka} = 1.1'' \times \frac{22}{7} = \frac{24.2}{7} = 3.46''.$$

$$\text{shipiah} = 2.4 \text{ cm} \times \frac{22}{7} = \frac{52.8}{7} = 7.5 \text{ cm.}$$

$$\text{shisuka} = 1.8 \text{ cm} \times \frac{22}{7} = \frac{39.6}{7} = 5.7 \text{ cm.}$$

Kumta ka *circumference* jong ka *circle*

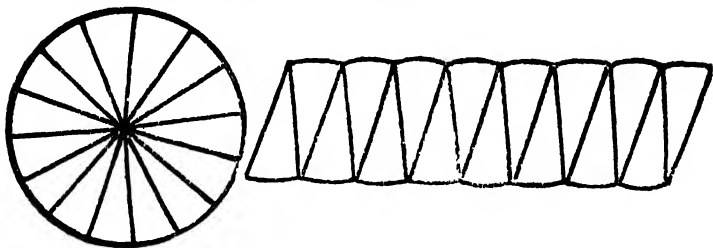
$$= \frac{22}{7} \times \text{diameter} = \frac{22}{7} \times 2 \text{ shah ia u radius.}$$

(namar ba u diameter = 2 shah ia u radius).

$$= \frac{22}{7} \times d \text{ lane } \frac{22}{7} \times 2r.$$

(haba d ka mut diameter bad r u radius).

B. Kumno yn shem ña ka jingheh sawdong (ne area) jong ka circle haba la shem ña u radius.



Ring kawei ka *circle* da u diameter 1.2".

Phiah ia ka ha ki 2, 4, 8 bad 16 bynta.

Ot lyngkhot lyngkhot bad pyndait bteng lang ter kum ha ka nuksa haneng.

Ngı shem ba ar ar tylli na ki ki long kum ki *rectangle*, Kumta ba 16 tylli na ki ki long kum 8 tylli ki *rectangle*.

Ka lynter jong ka *circumference* hangne ka long noh shiteng, namar ar tylli na ki triangle jong ki ki pynlong kum kawei ka *rectangle*.

Ka *area* jong ka *rectangle* = lynter \times pyngkiang.

Kumta ka *area* jong katei ka dur = lynter \times pyngkiang.
Ka lynter = $\frac{1}{2}$ jong ka *circumference* bad ka pynkiang = u *radius*.

$$\therefore \frac{1}{2} \text{ jong ka } \textit{circumference} \times \textit{pyngkiang}$$

$$= \frac{1}{2} \text{ jong ka } \textit{circumference} \times \textit{radius}$$

$$= \frac{1}{2} \text{ jong u } (\textit{diameter} \times \frac{22}{7}) \times \textit{radius}$$

$$(\text{namar } \textit{circumference} = \text{diameter} \times \frac{22}{7})$$

$$= \frac{1}{2} \times 1.2'' \times \frac{22}{7} \times \frac{1.2''}{2}$$

$$= \frac{15.84}{14} = \frac{7.92}{7} = 1.13 \text{ sq. in.}$$

\therefore ka *area* jong ka *circle*

$$= \frac{\textit{circumference} \times \textit{radius}}{2}$$

$$= \frac{1}{2} \times \text{diameter} \times \frac{22}{7} \times \textit{radius}$$

$$= \textit{radius} \times \frac{22}{7} \times \textit{radius}$$

$$= \frac{22}{7} \times \textit{radius} \times \textit{radius}$$

$$= \frac{22}{7} \times \textit{radius}^2$$

$$= \frac{22}{7} \times r^2 = \frac{22}{7} r^2$$

Shem ia (a) ka jingjrong ka *circumference* bad (b) ka *area* jong ka *circle* kiha don u diameter uba 4.2".

(a) Ka *circumference* jong ka *circle*

$$= \frac{22}{7} \times \text{diameter} = \frac{22}{7} \times 4.2 = 22 \times .6'' = 13.2''$$

(b) Ka *area* jong ka *circle*

$$= \frac{22}{7} \times \textit{radius} \times \textit{radius}$$

$$= \frac{22}{7} \times \frac{4.2''}{2} \times \frac{4.2''}{2}$$

$$= \frac{22}{7} \times 2.1'' \times 2.1'' = 22 \times .3 \times 2.1$$

$$= 6.6 \times 2.1 = 13.86 \text{ sq. in.}$$

JINGPYRSHANG 30

1. Shem ia ka jingjrong ka *circumference* jong ki *circle* kiba don kine ki *diameter* :—

(i) 3". (ii) 7cm. (iii) 7.7cm.

2. Shem ia ka jingjrong jong ka *circumference* jong ka *circle* kaba ki *radius* jong ki ki long kumne :—

(i) 3 5". (ii) 2.1cm. (iii) 4.9cm.

3. Wad ia ka *area* (ka jingheh sawdong) jong ki *circle* kiba don kine ki *radius* :—

(i) 2 1". (ii) 2.8cm. (iii) 5 6cm.

4. Shem ia ki *area* (ne jingheh sawdong) jong ki *circle* kiba don kine ki *diameter* :—

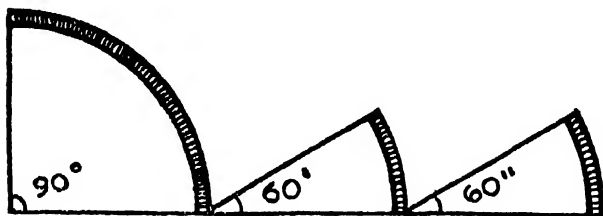
(i) 4.2". (ii) 8.4cm. (iii) 6.3cm.

Kine ki dak ne jingthoh harum la ju pyndonkam ha ka Geometry.

par ^m	ia	ka	parallelogram
sq	"	"	square.
alt.	"	"	alternate.
adj	"	"	adjacent.
diag	"	u	diagonal.
int	"	ka	interior.
ext.	"	"	exterior.
prob	"	"	problem.
r	"	u	radius.
5°	"	"	5 degree.
5'	"	"	5 minit.
5"	"	"	5 sekhon.

BYNTA III

15. KA JINGPYNBYNTA IA KA RIGHT ANGLE
SHA KI DEGREE, KI MINIT BAD KI SEKHON



Ia ka *right angle* ngi pynbynta ha ki 90 bynta kiba iaryngkat. Ia kawei ka bynta ngi khot ka *degree*. Nangta ngi pynjrong ia ki lain jong ka *angle* kaba shi *degree*. Ngi pynbynta ia ka pat ha ki 60 bynta kiba iaryngkat. Ia kine ki bynta ngi khot ki minit (minutes). Nangta ngi pynjrong biang ia ki lain jong ka *angle* kaba shiminit. Ngi pynbynta biang ia ka ha ki 60 bynta kiba iaryngkat. Ia kita ki bynta kiba rit ngi khot ki sekhon (seconds).

Kumta—

1 right \angle = 90 degree.

1 degree = 60 minit.

1 minit = 60 sekhon.

Lane,

60 sekhon = 1 minit.

60 minit = 1 degree.

90 degree = 1 rt. \angle .

Ia u degree la thoh lyngkot ($^{\circ}$).

Ia u minit „ „ „ ($'$).

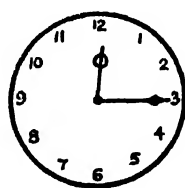
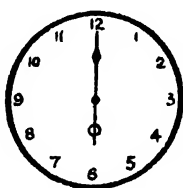
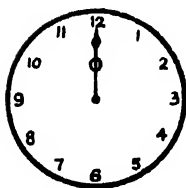
Ia u sekhon „ „ „ ($''$).

Kumta ia u 49 degree 59 minit 35 sekhon ngi thoh lyngkot $49^{\circ} 59' 35''$.

JINGPYRSHANG 31

1. Khein ãa ki *complement* jong kine :—
 $40^{\circ} 39'$, $59^{\circ} 49' 29''$, $17' 22''$, $5''$.
2. Shem ãa ki *supplement* jong kine :—
 $79^{\circ} 29'$, $154^{\circ} 30'$, $5^{\circ} 0' 59''$, $59' 59''$.
3. Wad ãa ki (i) *complement* bad ki (ii) *supplement* jong kine harum :—
 $\frac{25}{27}$ rt. \perp , $\frac{35}{36}$ rt. \perp , $\frac{77}{81}$ rt. \perp .

16. KI JINGTHEW BAD JINGKHEIN BAJE



Ka baje ka long ka dur sarkl (circle). Don ar tylli ne lai tylli ki kti baje kiba ãaid tawiar ãa lade kum ki redios (radius). U kti uba nyngkong eh u dei u kti kynta uba ãaihuh por ãa ki kynta. Une barobor u long uba kham lyngkot. Ha ka baje don 12 dak, kata 12 kynta. U kti kynta u ãaid na u 1 sha u 2, bad kata u kdew shikynta. Haba u ãaid tawiar ãa ka baje baroh kawei shisien tawiar u pynlong 360° ne 4 rt. \perp ha ki 12 kynta.

Kumta haba u kdew 6 baje thik, u pynlong ka angle kaba 180° ne 2 rt. \perp . Haba u kdew 3 baje

thik, u thaw ka angle kaba shi rt. \perp bad u kti minit.

Ngi ioh ia kane ka jingkheñ, te—

Ha ki 3 kynta u kti kynta u ñaid 90° .

„ „ 1 „ „ „ „ „ „ 30° .

Kata, u pynlong 30° ha man la ka shikynta.

Kumta, ha ka 5 kynta u pynlong $30^\circ \times 5 = 150^\circ$.

Bad „ „ 8 „ „ „ „ $30^\circ \times 8 = 240^\circ$.

Bad kumta ter ter.

(1) Ha ki 3 kynta 15 minit u kti kynta u pynlong ka angle kaba $30^\circ \times 3\frac{1}{2} = 30^\circ \times 3\frac{1}{4} = 90^\circ + 7\frac{1}{2}^\circ = 97\frac{1}{2}^\circ$.

(2) Ia ka 30° u kti kynta u shim por ban ñaid 1 kynta.

Ia ka 1° u kti kynta u shim por ban ñaid $\frac{1}{30}$ kynta.

Ia ka 25° u kti kynta u shim por ban ñaid $\frac{25}{30}$ kynta.

Kata, $\frac{25}{30} \times 60 \text{ minit} = 50 \text{ minit}$.

U kti uba ar u long u kti baje uba jrong eh uba ngi khot u kti minit. Une u tawiar ia ka baje baroh sawdong ha ki 60 minit. Kata, u ñaid 360° ha ki 60 minit

Lane, u shim por 60 minit ban ñaid ia ka 360° .

Kumta „ „ „ 1 „ „ „ „ „ „ 6° .

U kti minit, namarkata, u thaw angle 6° man la ka shiminit.

(1) Ha ka 1 minit u kti minit u phai ka angle kaba 6° .

Ha ka $35\frac{1}{2}$ minit u kti minit u phai ka angle kaba $6^\circ \times 35\frac{1}{2} = 210^\circ + 3^\circ = 213^\circ$.

(2) Ia ka 6° u minit u shim por ban ñaid 1 minit.

Ia ka 1° u minit u shim por ban ñaid $\frac{1}{6}$ minit.

Ia ka 45° u minit u shim por ban ñaid $\frac{1}{6} \times 45 = \frac{15}{2}$ minit lane $7\frac{1}{2}$ minit lane 7 minit 30 sekhon.

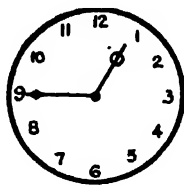
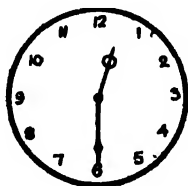
U kti balyngkot eh u dei u kti sekhn. Une u phai ha kajuha ka rukom kum u kti minit, kata u ñaid 360° ha ki 60 sekhn. Hynrei don bún ki baje ki bam don ña une u kti sekhn.

JINGPYRSHANG 32

1. Ka por ka long 12 baje thik mynta.

(a) katno degree u kti kynta u phai da kaba kdew 3 baje, 6 baje bad 9 baje thik ?

(b) Katno degree pat u kti minit u phai da kaba u kdew 12 baje shipawa, 12 baje shiteng bad shi baje duna shipawa ?



2. (a) Kheĩñ ña ka jingheh ki angle ba u kti minit jong ka baje u thaw da kaba u phai ha ki :—

(i) $30'$; (ii) $10'$; (iii) $45'$; (iv) $22\frac{1}{2}'$; (v) $15' 20''$.

(b) Kan shim por katno minit ba u kti minit un phai lyngba ña ki (i) 30° , (ii) 60° , (iii) 120° , (iv) 75° , (v) 202° .

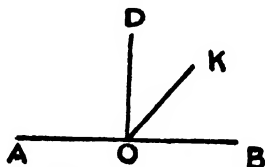
3. (a) Kheĩñ ña ka jingheh ki angle ba u kti kynta u ñaid naduh 12 baje shiteng sngi haduh (i) 3 baje shiteng janmict. (ii) 5 baje $\frac{1}{4}$ (iii) bad 9 baje duna $\frac{1}{4}$.

(b) Da kaba peit baje 12 baje thik mynsngi, katno baje u kynta un phai ha ki (i) 60° , (ii) 75° bad 105° ?

4. Ka pyrthei ka tawiar sawdong hi ia lade (kata, 360°) ha u *axis* jong ka ha ki 24 kynta. Lyngba katno ka angle ka phai ha ki 3 kynta shiteng? Kan shim por katno ban phai ia ka angle kaba 140° ?

17. KA JINGIARYNGKAT HA KI ANGLE

Ki *angle* ha kawei ka liang jong ujuh u lain ki iaryngkat lang ar *right angle*.



Ring u lain **AB** bad buh point **O** ha u **AB**. Ka angle **AOB** ka long ka angle ha u lain bad ka long ar *right angle*.

Ha u point **O** ring uno uno u lain **OK**.

Kumjuh ki $\angle \mathbf{AOK}$ bad \mathbf{KOB} ki = 2 rt. \perp

Ring pat u lain **OD** uba ieng beit ha u **AB**.

Ka $\angle \mathbf{AOD}$ bad ka $\angle \mathbf{DOB}$ ki = 2 rt. \perp .

Ka jingbatai lyngkot :— Haba ka $\angle \mathbf{AOD}$
= ka $\angle \mathbf{DOB}$,

Kawei kawei ka dei ban long shi *right angle*.

Kumta ba u **OD** u long perpendicular ha u **AB**.

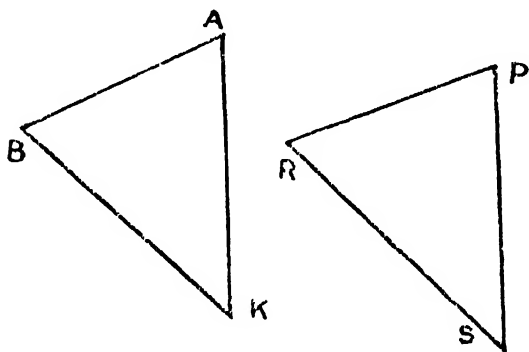
Kumta haba uwei u lain u ieng halor uwei pat u lain bad ar tylli ki angle baroh ar liang ki iaryngkat, kita ki lain ki ialong *perpendicular* uwei ia uwei.

18. KA JINGIARYNGKAT HA KI TRIANGLE

Ia ka angle ha ka triangle kaba la ker ne kdup da ki ar tylli ki lain kiba ker la khot ka included angle.

(a) Shna ar tylli ki $\triangle ABK$ bad $\triangle PRS$ kiba don kine harum :—

$AB = 1'1'' = PR$, $AK = 1'5'' = PS$,
 bad ka *included* $\angle A = 70^\circ =$ ka *included* $\angle P$.
 Thew katno kiwei pat ki lain **BK** bad **RS**.
 „ „ „ „ „ $\angle R$ bad $\angle B$.
 „ „ „ „ „ $\angle S$ „ $\angle K$.



Ngi ring u lain **AB** uba iaryngkat $1'1''$.
 Nangta ngi shna ka $\angle BAK$ kaba 70° .
 Ngi pynjrong pat ia u **AK** ban long $1'5''$.

Ngi pyniasoh **BK**.

Kumjuh ngi leh ia ka $\triangle PRS$.

Da kaba thew ngi shem ba—

$BK = RS = 1'4''$,
 $\angle B = \angle R = 65^\circ$,
 $\angle K = \angle S = 45^\circ$.

Kumta na kine ngi rai, ba **ha ki triangle ar tylli, haba ar tylli ki lain jong kawei ka triangle ki iaryngkat ia ki ar tylli ki lain jong kawei pat, para marwei, bad ka included angle ruh ka iaryngkat bad ka included angle jong kawei pat ka triangle, kita ki triangle kin iaryngkat ha kiwei de ki lain bad ki angle.**

Khmi h bha—ha ki triangle kiba iaryngkat nadong nadong,

haba ka $\angle A = \angle P$, te u **a = u p.**

„ „ $\angle B = \angle R$, „ „ **b = „ r.**

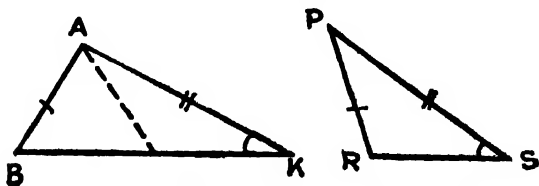
„ „ $\angle K = \angle S$, „ „ **k = „ s**

Kata, kiba iapyrshah ia ki para ba iaryngkat ki iaryngkat.

Khmi h bha ia kane pat :—

Lada ar tylli ki lain jong kawei ka triangle ki iaryngkat, para marwei, ia ki ar tylli ki lain jong kawei pat ka triangle, bad ka angle bam shym ker da kita ki lain jong ka triangle banyngkong ki iaryngkat bad ka angle ba la ker da kita ki lain jong ka triangle baar ; kita ki triangle **pat kin nym iaryngkat.**

Khmi h kum ha ki dur harum :—



Haba thew u **AB = PR**, u **AK = PS**,

Bad ka \angle **AKB** (bam shym ker da u **AB** bad **AK**) = \angle **RPS** (ba la ker pat da u **PR** bad **PS**).

Hynrei kine ki \triangle kim iaryngkat satia.

JINGPYRSHANG 33

Shna ki \triangle kiba don kine harum bad thew ia kiwei pat ki lain bad ki angle ; ki ialong mar katno ?

$$(a) \mathbf{b} = 1'' = \mathbf{r} ; \mathbf{k} = 2'' = \mathbf{s} ; \angle \mathbf{A} = 100^\circ = \angle \mathbf{P}.$$

$$(b) \mathbf{b} = 4\text{cm} = \mathbf{r} ; \mathbf{k} = 3\text{cm} = \mathbf{s} ; \\ \angle \mathbf{A} = \angle \mathbf{P} = 90^\circ.$$

$$(k) \angle \mathbf{D} = \angle \mathbf{X} = 60^\circ ; \mathbf{e} = 1'3'' = \mathbf{y} ; \\ \mathbf{f} = 1'3'' = \mathbf{z}.$$

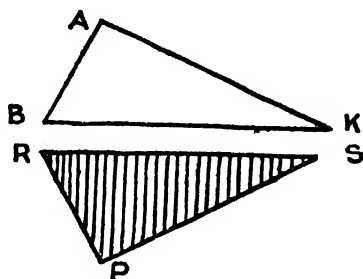
$$(d) \angle \mathbf{E} = \angle \mathbf{Y} = 30^\circ ; \mathbf{d} = 2'' = \mathbf{x} ; \\ \mathbf{f} = 2'' = \mathbf{z}.$$

$$(e) \angle \mathbf{F} = \angle \mathbf{Z} = 120^\circ ; \mathbf{d} = 2\text{cm} = \mathbf{x} ; \\ \mathbf{e} = 3\text{cm} = \mathbf{y}.$$

$$(g) \mathbf{b} = \mathbf{r} = 2'' ; \mathbf{k} = \mathbf{s} = 1'' ; \\ \angle \mathbf{A} = \angle \quad = 180^\circ.$$

(b) Don ar tylli ki triangle **ABK** bad **PRS**, bad haba thew shem ba u **AB** = **PR**, u **AK** = **PS**, bad ka included \angle **BAK** = ka included \angle **RPS**.

Ki triangle **ABK** bad **PRS** kin iaryngkat ne ém nadong shadong ? Pynshisha.



Jingpynshisha —Ngi khap ne trud pynbúd ãa ka $\triangle PRS$ bad rah ãa ka ha ka $\triangle ABK$. Ngi buh ãa ka khmut angle **P** hamar ka khmut angle **A**. Nangta ngi pynháp ãa u lain **PR** ha u lain **AB** para baíaryngkat, bad ãa u lain **PS** pat sha u lain **AK**. Bad namar ba ka $\angle RPS = \text{ka } \angle BAK$, u **PS** un shu háp hi ha u lain **AK**.

Te namar u **PR** = ãa u **AB**

U **R** un háp thik hamar u **B**.

Bad namar ba u **PS** u iaryngkat ãa u **AK**.

U **S** pat un háp thik hamar u **K**

Kumta ba u **R** un háp ha u **B** bad u **S** ha u **K**.

Bad u **RS** un háp thik hamar u **BK**.

Kumta ka $\triangle PRS$ kan íasyrtap thik bad ka $\triangle ABK$ nadong shadong. Kumta ki iaryngkat ruh nadong shadong.

Kata, khlem da thew shuh u **RS=BK**

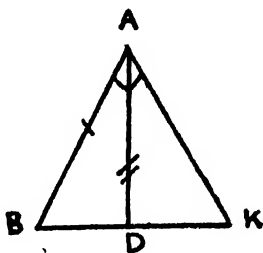
ka $\angle PRS = \text{ka } \angle ABK$, lane ka $\angle R = \text{ka } \angle B$;
ka $\angle PSR = \text{ka } \angle AKB$, „ „ $\angle S = \text{„ } \angle K$.

(k) **ABK** ka long ka *isosceles* triangle, kumta ba **AB=AK**. U **AD** u phiah ia ka \angle **BAK** marshiteng bad iakynduh ia u **BK** ha u **D**.

Pyni ba u **AD** u long *perpendicular* ha u **BK**.

Ngi shna ka *isosceles* triangle **ABK** kaba u **AB=AK**. Ngi phiah marshiteng ia ka \angle **BAK** da u lain **AD** uba iakynduh ia u **BK** ha u **D**.

(Lah ban leh ia kane da ka jingiarap ka *protractor* ne *set square*).



Jingpynshisha.—Ha ki \triangle **ADB, ADK**.

(i) **AB=AK**.

(ii) **AD** u ieng pdeng.

(iii) ka *included* \angle **BAD**=ka *included* \angle **KAD**.
(lane, ki \angle **BAD, KAD**, ha kiba kine ki lain ki iakynduh ki iaryngkat.)

Kumta, ba ka \angle **ADB** = ka \angle **ADK**.

Hyurei kine baroh ar ki pynlong 2 rt. \perp .

Kumta kawei kawei ka long shi rt. \perp ne 90° .

\therefore u **AD** u long *perpendicular* ha u **BK**.

La pynshisha.

JINGPYRSHANG 34.

Ha ka rukom jong ka (k) ka nuksa ba la ai, leh ia kine harum :—

1. U **O** u long hamar shiteng u **AB**. Ring *perpendicular* **OK** ha u **AB**. Pyniasoh **KA** bad **KB**. Pyni ba ki \triangle **KOA** bad **KOB** ki iaryngkat.

2. U **K** u long hamar pdeng u lain **AB**. Ring *perpendicular* **KO** ha u **AB**. Shim uno uno u point **M** ha u **KO**. Pyniasoh **MA** bad **MB**. Pyni ba ki \triangle **MKA** bad **MKB** ki iaryngkat, bad ba ki lain **MA** bad **MB** ki iaryngkat.

3. Ka **ABK** ka long *isosceles* triangle, kumta ba **AB=AK**. U **AD** u phiah marshiteng ia ka \angle **BAK**, bad u iakynduh ia u **BK** ha u **D**. Pyni ba **BD=DK**.

4. Ka **ABK** ka long *isosceles* triangle, kumta ba **AB=BK**. U **BD** u phiah marshiteng ia ka \angle **ABK** bad u iakynduh ia u **AK** ha u **D**. Pyni ba ka \angle **BDA** = ka \angle **BDK**.

5. Ha ka \triangle **ABK** u **AD** u long u *perpendicular* ha u **BK** bad ot marshiteng ia u **BK** ha u **D**. Pyni ba **AB=AK**, kata ba ka **ABK** ka long *isosceles* triangle.

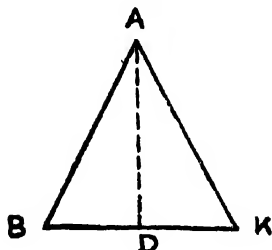
6. **ABK** bad **DKB** ki long ki *right angled* \triangle ha ujuh u lain **BK** ki da long *right angle* ha ka \angle **B** bad **K**, kumta ba **AB=DK** Pyni ba **AK=BD**.

7. Ha ka \triangle **ABK**, u **D** u long u pdeng jong u **AK**. Pyniasoh **BD** bad pynjrong sha u **E** pynlong **DE=BD**. Pyniasoh **EK**. Pyni ba ki \triangle **BAD**, **EKD** ki iaryngkat bad ba ka \angle **BAD** = ka \angle **EKD**.

(d) Ka triangle **ABK** ka long ka *isosceles* triangle, kumta ba **$AB=AK$** . Pyni ba ka $\angle B = \text{ka } \angle K$.

Ngi shna ka *isosceles* triangle **ABK**.

Ngi phiah ia ka $\angle BAK$ da u lain **AD** uba iakynduh ia u **BK** ha u **D**.



Ka buit pynshisha ka banyngkong

(i) Ngi khylliap ia ka $\triangle ABK$ hamar ulain **AD**. Bad namar ba ka $\angle BAD = \text{ka } \angle KAD$, u **AK** un háp ha u lain **AB**.

Bad namar ba u **$AK=AB$** .

U **K** un háp thik ha u **B**.

Kumta ba u **DK** un wan kylla long **DB**. Bad k1 $\triangle ADB, ADK$ ki iasyrtap thik nadong shadong Kumta ki iaryngkat ruh nadong shadong.

Bad namar ba ka $\angle ABD$ ka iasyrtap thik bad ka $\angle AKD$.

$\therefore \text{ka } \angle ABK = \text{ka } \angle AKD$.

La pynshisha.

Ka buit pynshisha ka baar

Ha ki $\triangle ADB, ADK,$

Namar ba (i) $AB=AK$, (ii) $AD=AD$ bad (iii) ka included $\angle BAD =$ ka included $\angle KAD$.

\therefore ki $\triangle ADB$ bad ADK kin iaryngkat nadong shadong.

Kumta ba ka $\angle ABK =$ ka $\angle AKB$.

Nangtei ngi iohi 'a ha ka isosceles triangle ki angle ki iaryngkat haba ki iapyrshah ia ki lain baiaryngkat.

Kumjuh ruh ha ka equilateral triangle ki angle baroh lai tylli ki iaryngkat. Kumta kawei kawei ka angle ka long 60° .

JINGPYRSHANG 35.

1. Ka $\triangle ABK$ ka don ki angle ABK, AKB kiba iaryngkat 60° . Ia u lain BK la pynjrong arliang na u B sha u D bad na u K sha u E . Katno ki $\angle ABD$ bad $\angle AKE$ ki ialong?

2. Ka $\triangle ABK$ ka don ki lain baroh lai kiba iaryngkat $2''$. Shem ia ka jingheh kawei pa kawei ka angle.

3. Ka $\triangle ABK$ ka don ki angle ABK , AKB kiba iaryngkat 72° . Ia u AB la pynjrong sha lyndet u BK sha u D bad ia u AK sha u E . Shem katno ka jingheh jong ki $\angle KBD$, BKE . Ki iaryngkat ne ém ?

4. Ki $\triangle ABK$, DBK ki long ki isos \triangle ha baroh ar liang u BK . Ka $\angle ABK = 60^\circ =$ ka $\angle AKB$. Ka $\angle DBK = 45^\circ =$ ka $\angle DKB$. Shem ka $\angle ABD$ ka iaryngkat ne ém ia ka $\angle AKD$.

5. Ki $\triangle ABK$, DBK ki long ha baroh ar liang u BK . U $AB = BD$, u $AK = KD$. Pyniasoh AD . Ka $\angle BAK$ ka iaryngkat bad ka $\angle BDK$? Kumno ?

6. Ki $\triangle ABD$, AKD ki long ki isos \triangle ha baroh ar liang ujuh u lain AD . Ka $\angle BAD =$ ka $\angle BDA = 40^\circ$. Ka $\angle KAD =$ ka $\angle KDA = 80^\circ$. Ka $\angle BAK$ bad ka $\angle BDK$ ki ialong mar katno ?

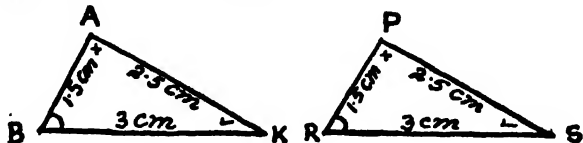
7. Ha ki $\triangle ABK$, PRS , u $AB = PR$, u $AK = PS$ bad u $BK = RS$. Pyni ka $\angle BAK$ ka iaryngkat ne ém ia ka $\angle RPS$?

(Buit—Rah ia ka $\triangle ABK$ sha ka $\triangle PRS$, kumta ba u BK un háp ha u RS bad u K ha u S . Sa pynthung khongpong ia ka $\triangle ABK$, tharai ka DRS ka long ka \triangle thymmai ba mihpli. Pyniasoh PD . Sa pynshisha).

(e) Shna ka triangle **ABK** bad **PRS** kiba don kine harum :—

$$a = 3\text{cm} = p, \quad b = 2.5\text{cm} = r, \quad k = 1.5\text{cm} = s.$$

Thew ia ki $\angle A, B$ bad K ki iaryngkat de ne ém bad ki $\angle P, R$ bad S .



Ngi ring u lain **BK** bad **RS** kiba 3cm.

Na *centre* **B** bad **R** bad da u *radius* uba 1.5cm ngi ring *arc* shaneng u **BK** bad **RS**. Na *centre* **K** bad **S** bad u *radius* uba 2.5cm ngi ring *arc* sa kiwei ban ot ia kiba mynshuwa ha ki point **A** bad **P**. Ngi pyniasoh **AB, AK, PR** bad **PS**.

Te kine ki \triangle **ABK** bad **PRS** ki long ki \triangle kiba iaryngkat ki lain baroh lai.

Ngi thew da ka *protractor* ia ki $\angle A, B$ bad K bad ngi shem ki long $93^\circ, 56^\circ$ bad 31° , thik hi kum ki $\angle P, R$ bad S . Namarkata, ki angle ruh ki iaryngkat baroh lai.

Kumta **haba baroh lai ki lain jong ki ar tylli ki \triangle ki iaryngkat uwei ia uwei, ki angle baiapyrshah ia ki lain baiaryngkat ruh ki iaryngkat kawei ia kawei.**

Kumta haba $\mathbf{a} = \mathbf{p}$, $\mathbf{b} = \mathbf{r}$, $\mathbf{k} = \mathbf{s}$.

Ka $\angle \mathbf{A} = \angle \mathbf{P}$, $\angle \mathbf{B} = \angle \mathbf{R}$,
 $\angle \mathbf{K} = \angle \mathbf{S}$.

JINGPYRSHANG 36

Shna ki triangle ar tylli kiba don kine harum bad thew ña ki angle jong ki ki ñalong mar katno ?

(a) $a = 3'' = p$, $b = 2'' = r$, $k = 1'' = s$.

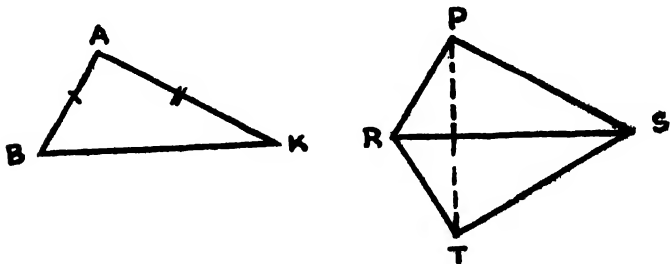
(b) $a = 2.5'' = d$, $b = 2'' = e$, $k = 2'' = g$.

(k) $a = 5\text{cm} = x$, $b = 4\text{cm} = y$, $k = 3\text{cm} = z$.

(d) $a = 2'' = l$, $b = 5\text{cm} = m$, $k = 50\text{mm} = n$.

(e) $a = 8\text{cm} = o$, $b = 1.5'' = e$, $k = 30\text{mm} = m$.

(g) Shna ar tylli ki $\triangle \mathbf{ABK}$ bad \mathbf{PRS} , kumta ba $\mathbf{a} = \mathbf{p}$, $\mathbf{b} = \mathbf{r}$, $\mathbf{k} = \mathbf{s}$, bad pynshisha ba ki ñaryngkat nadong shadong.



Ngi shna kano kano ka $\triangle \mathbf{ABK}$. Nangta ngi.

ring u lain **RS** uba iaryngkat ia u **BK**. Na *centre* **R** bad u *radius* **BA** ngi ring *arc* shaneng u **RS**. Na *centre* **S** bad u *radius* **AK** ngi ring sa kawei pat ka *arc* ban ot ia kaba mynshuwa ha u **P**.

Pyniasoh **PR** bad **PS**.

Ngi khap ne trúd pynbúd ia ka \triangle **ABK** bad ngi rah ia ka ha ka \triangle **PRS**, ngi da pynháp ia u **BK** para baiaryngkat ha u **RS**. Nangta ngi pynthung khongpong ia ka triangle kumta u point **A** u háp shathie na u **RS**.

Ngi khot noh ia kane ka \triangle thymmai \triangle **TRS**.

Ngi pyniasoh **PT**.

U **PR** = u **AB** = **RT**. (kumta ka long isos \triangle)

\therefore ka \angle **RPT** = ka \angle **RTP**.

U **PS** = **AK** = **TS**. (kumta ka long isos \triangle)

\therefore ka \angle **SPT** = ka \angle **STP**.

Kumta baroh kawei ka \angle **RPS** = baroh kawei ka \angle **RTS** = ka \angle **BAK**.

Kumta namar ba (1) **AB** = **PR**.

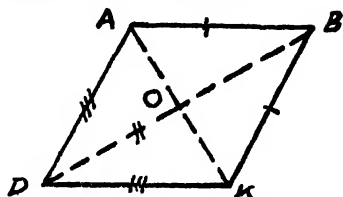
(2) **AK** = **PS**.

bad (3) ka *included* \angle **BAK** = ka *included* \angle **RPS**.

Namarkata, kine ki \triangle ki iaryngkat nadong shadong.
La dep pynshisha.

(ng) **ABKD** ka long ka *rhombus*. **AK**, **BD** ki long ki diagonal jong ka. Pyni ba kine ki diagonal ki ialong *perpendicular*, uwei ha uwei.

Ngi shna ka dur *rhombus* **ABKD**. Ngi ring ki diagonal **AK**, **BD** kiba iapom ha u point **O**.



Jingpynshisha.—Ha ki $\triangle ABD$, **KBD**.

- Namar ba
- (1) **AB** = **BK**.
 - (2) **BD** u ieng pdeng.
 - (3) **AD** = **KD**.

Kata, kine ki \triangle ki iaryngkat nadong shadong.

Kumta ka $\angle ABD$ = ka $\angle KBD$.

Nangta ha ki $\triangle ABO$, **KBO**.

- Namar ba
- (1) **BA** = **BK**.
 - (2) **BO** u ieng pdeng.
 - (3) Ki $\angle ABO$, **KBO** ba iakynduh da kine ki lain ki iaryngkat.

Kata, kine ki \triangle ruh ki iaryngkat nadong shadong.

Kumta ka $\angle AOB$ = ka $\angle KOB$.

Hynrei ar tylli kine ki $\angle = 2$ rt. \angle .

Kumta kawei kawei ka long shi rt. \angle .

Kumjuh ruh ki \angle **AOD** bad **KOD** kiba
pyrshah ia ki rt. \perp ki long ki rt. \perp .

\therefore u **AK** bad **BD** ki ialong *perpendicular*.

La pynshisha.

JINGPYRSHANG 37

1. Ka **ABK** ka long ka isos \triangle ha kaba u
AB = **AK**. U **O** u long pdeng jong u lain **BK**.
Pyniasoh **AO**. Pyni ba—

- (i) ka \triangle **AOB** = ka \triangle **AOK**.
- (ii) Ka \angle **BAO** = ka \angle **KAO**.
- (iii) Ka „ **AOB** = ka „ **AOK**.

2. **ABK** bad **DBK** ki long ki ar tylli ki isos \triangle
ha ka liang baipyrshah jong ujuh u lain **BK**.
Pyniasoh **AD**.

- Pyni ba
- (i) Ka \angle **ABD** = ka \angle **AKD**.
 - (ii) Ka „ **BAD** = ka „ **KAD**.
 - (iii) Ka „ **BDA** = ka „ **KDA**.

3. **ABK** bad **DBK** ki long ki ar tylli ki isos \triangle
ha kajuha ka liang jong u lain **BK**. Pyniasoh **AD**.

- Pyni ba
- (i) Ka \angle **BAD** = ka \angle **KAD**.
 - (ii) Ka „ **ADB** = ka „ **ADK**.
 - (iii) Ka „ **ABD** = ka „ **AKD**.

4. **ABKD** ka long ka *rhombus* ha kaba baroh saw tylli ki lain bakér jong ka ki ñaryng cat. Ring u diagonal **AK**.

- Pyni ba (i) Ka $\angle \mathbf{ABK} = \text{ka } \angle \mathbf{ADK}$.
 (ii) Ka „ **BAK** = ka „ **DAK**.
 (iii) Ka „ **BKA** = ka „ **DKA**.

5. **ABKD** ka long ka parallelogram ha kaba u **AB** = u **DK**, u **AD** = **BK**.

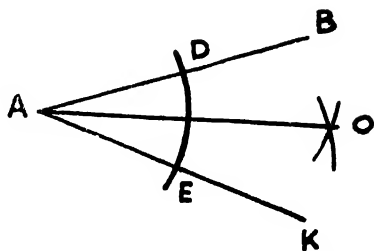
- Pyni ba (i) Ka $\angle \mathbf{DAB} = \text{ka } \angle \mathbf{DKB}$.
 (ii) Ka „ **ABD** = ka „ **KDB**.
 (iii) Ka „ **ADB** = ka „ **KBD**.

19. KA JINGPHIAH IA KA ANGLE

Problem I.

Phiah ar liang ia ka angle ba la ai.

Ai ba **BAK** kan long ka angle ba la ai ba yn phiah ar liang (bisected).



Ka jingshna-dur—Na centre **A**, bad da u radius uba duna ia u **AB** bad **AK**, ring arc ban ot ia u **AB** ha u **D** bad ia u **AK** ha u **E**.

Na centre **D** bad da u radius **DE** ngi ring arc jngai na u **A** sha kawei ka liang u **DE**; bad na centre **E** bad da u juh u radius ring arc biang ban ot ia kaba mynshuwa ha u point **O**.

Pyniasoh **AO**.

Te ia ka \angle **BAK** la phiah ar liang da u lain **AO**.

Jingpynshisha.—Pyniasoh **DO**, **EO**.

Te ha ki \triangle **ADO**, **AEO**.

(1) **AD** = **AE** (ki radius jong kajuha ka \odot)

(2) **DO** = **EO** (ki *radius* jong ki \odot baia-ryngkat).

(3) **AO** u ieng pdeng ha baroh ar ki \triangle .

\therefore ki \triangle baroh ar ki iaryngkat nadong shadong.

Kumta ka \angle **DAO** = ka \angle **EAO**.

Kata, ia ka \angle **BAK** la phiah ar liang phiak da u **AO**.

La pyndep.

Jingbatai lyngkot —Ia u *radius* **DE** lah ban shim da uno uno u *radius* tang ba un palat la kumno kumno shiteng ia u **DE**, ba ki *arc* kin iapom.

KA BUIT KA BAAR

Ai ba **BAK** kan long ka angle ba la ai ia ka ban phiah ar liang.

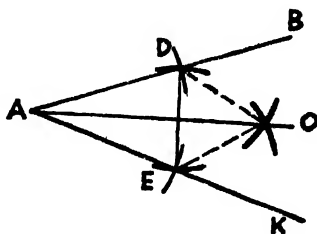
Jingshnadur.—Na u **AB** bad **AK** ot **AD** bad **AE** kiba iaryngkat (da u *compasses* ne *divider*).

Pyniasoh **DE**.

Ha u **DE** shna ka *equilateral* \triangle **ODE**.

Pyniasoh **AO**.

Te u **AO** u phiah ia ka \angle **BAK**.



Jingpynshisha.—Ha ki \triangle **DAO**, **EA** \cap .

(1) **AD** = **AE** (kumba la leh haneng).

(2) **AO** u ïeng pdeng.

(3) **DO** = **EO** (kumba la leh haneng).

Kumta ki \triangle ki ïaryngkat nadong shadong.

Kata, ba ka \angle **DAO** = ka \angle **EAO**.

Kumta u **AO** u phiah marshiteng ïa ka \angle **BAK**.

La pyndep.

Jingbatai lyngkot —Lada shna da ka isos \triangle ha u **DE**, ba u lain **DO** bad **EO** kin ïaryngkat, lah ban pynshisha hi kumjuh.

JINGPYRSHANG 38

Barobor ring dar da ka jingïarap u compases bad da pynshynna ïa ki arc.

1. Phiah ïa ki angle kiba 67° , 91° , 123° .

2. Phiah ha ki saw bynta ki baïaryngkat ïa ki \angle kiba 57° , 89° , 180° (ym donkam pynshisha).

3. Ring u lain **OK** ha u lain **AOB**. Phiah' ïa ki \angle **AOK**, **KOB** da ki lain **OR** bad **OT**. Katno ka \angle **TOR** kan long ?

4. Shna ka *acute-angled* \triangle bad phiah' ïa kawei pa kawei ka \angle . Pyni hangno ki lain kiba phiah' ki ïakynduh. Pyni tang da ka dur.

5. Shna ka (i) *right-angled* \triangle bad (ii) ka *obtuse-angled* \triangle bad phiah' ïa kawei pa kawei ka \angle . Shu pyni tang da ka dur hangno ki lain kin ïakynduh.

20. KA JINGOT MARSHITENG IA U LAIN

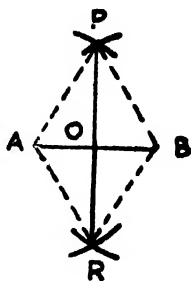
Problem 2.

Ot marshiteng ïa u lain ba l i ai

Ai ba **AB** u long u lain ba yn ot marshiteng.

Jingshnadur.—Na *centre A*, bad da u *radius AB*, ring ar tylli ki *arc*, ha baroh ar liang u **AB**.

Na *centre B*, bad da ujuh u *radius BA*, ring ar tylli ki *arc*, ha baroh ar liang u **AB**, ba kin ïa ot ïa kiba mynshuwa ha u **P** bad u **R**.



Jingpynshisha.—Pyniasoh **AP**, **AR**, **BP**, **BR**.

Ha ki \triangle **APR**, **BPR**.

(1) **AP** = **BP** (= **AB** u *radius* jong ki \odot)

(2) **AR** = **BR** (na kajuh ka daw)

(3) **PR** u ieng pdeng ha baroh ar ki \triangle .

\therefore ki ar tylli ki \triangle ki iaryngkat nadong shadong.

\therefore ka \angle **APR** = ka \angle **BPR**.

Nangta pat ha ki \triangle **APO**, **BPO**.

(1) **AP** = **BP**.

(2) **PO** u ieng pdeng.

(3) ka \angle **APO** = ka \angle **BPO** (la pyni haneng)

\therefore ki \triangle ki iaryngkat nadong shadong.

\therefore **AO** = **BO**.

Kata, la ot marshiteng ia u **AB** ha u pt. **O**.

La pyndep.

Jingbatai lyngkot.—(i) Lada u **AB** u jrong eh, lah ban shim *radius* da uno uno u ban kham jrong khyndiat ia shiteng jong u **AB**, khnang ban pyniapom ia ki *arc*.

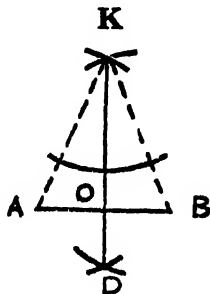
(ii) Na ka jingiaryngkat ki \triangle **APO**, **BPO**, lah ban pyni ba u **PO** u long u *perpendicular* ha u **AB**.

KA BUIT KA BAAR.

Ot ia u lain ha ki ar tylli ki l ynta ba'aryngkat.

Ai ba u **AB** un long uta u lain ba yn ot marshiteng.

Jingshnadur.—Shna ka isos $\triangle KAB$, ha u **BA**. Kata, shim *centre* ha u **A** bad u **B** bad da ujuh u *radius* pyn'iaot ia ki *arc* ha u **K** bad sa pyn'iasoh **AK**, **BK**.



Phiah ia ka $\angle AKB$ da u lain **KD**, bad ai un iakynduh ia u **AB** ha u pt. **O**.

Te u **O** u long hamar shiteng u **AB**.

Jingpynshisha.—Ha ki $\triangle KOA$, **KOB**.

(1) **KA = KB**. (Kumba la leh haneng).

(2) **KO** u ieng pdeng.

(3) ka *included* $\angle AKO =$ ka *included* $\angle BKO$.

\therefore ki \triangle ki iaryngkat nadong shadong.

Kumta ba **AO = OB**.

Kata, ba u **O** u long ha marshiteng u **AB**.

Na kajuh ka daw, u **KO** u long *perpendicular* ia u **AB**.

La pyndep.

JINGPYRSHANG 32

(Ring dur da ka jingiarap u *compasses* bad pyni shynna ia ki *arc*.)

1. Ot marshiteng ia u lain uba (i) $2\frac{1}{2}''$.
(ii) 5.3cm. (iii) 77mm.

2. Ot marshiteng ia u lain uba $3''$, nangta ot biang ia ki sa marshiteng. (Shna dur khlem da pynshisha).

3. Ot ha ki saw bynta baiaryngkat ia u lain uba 6.3cm (Ring ka dur ba shai bha).

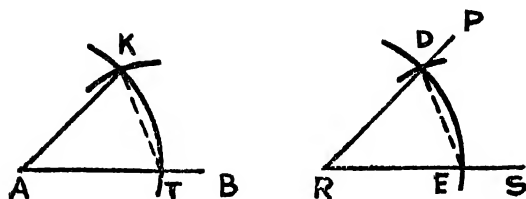
4. Shna ka *acute-angled* \triangle **ABK** bad ot marshiteng ia ki lain baroh lai. Pyni ha ka dur, khlem batai, hangno ki lain kiba ot marshiteng ki iakynduh.

5. Shna ka (i) *right-angled* \triangle bad ka *obtuse-angled* \triangle . Ot marshiteng ia ki lain jong ki baroh lai. Pyni hangno ki lain kiba ot marshiteng ki iakynduh. (Ring tang ki dur).

21. KA JINGSHNA ANGLE

Problem 3

Ha u point ba ha u lain, shna angle kawei kaba kat ka angle ba la ai



Ha u point **A** ha u lain **AB** ban shna ka angle kaba kat ka \angle **PRS**.

Jingshnadur.—Na centre **R** bad da u radius uba kat ban bit, ring arc ban pom ña u **RP** bad **RS** ha ki point **D** bad **E**.

Na centre **A** bad da ujuh u radius **RE** ring arc ban ot ña u **AB** ha u **T**.

Na centre **T** bad da u radius kat u **DE** ring arc ban ot ña kaba mynshuwa ha u **K**.

Pyniasoh **AK**.

Te ka \angle **BAK** ka long kata ka angle.

Jingpynshisha.—Pyniasoh **DE**, **KT**.

Ha ki \triangle **AKT**, **RDE**.

Namarba 1. **AK** = **RD**,

2. **AT** = **RE**,

3. **KT** = **DE**.

∴ ki \triangle ki iaryngkat nadong shadong.

Kumta ka \angle **KAT** = ka \angle **DRE**.

Kata, ba ka \angle **BAK** = ka \angle **PRS**.

La pyndep.

Lada ngi kwah ban shna ka angle kaba arshah ia ka \angle **PRS**, ngi jam na u **K** sa shisien jam kat u **KT** ban ot ia ka *circumference*. Nangta pyniasoh **A** ha u point ba ki iaot. Lada ngi kwah lai shah ngi jam pat lai jam kat u **KT** na u **T**. Bad kumta ter ter.

JINGPYRSHANG 40

1. Shna kawei ka \angle **ABK** kaba kat kawei ka \angle **LMN** (da batai kumno phi leh.)

2. Ring da ka *protractor* ki angle kiba 30° , 45° , 90° bad 135° . Shna da u *ruler* bad u *compasses* ki angle kiba kat kitei ba la ring. (Pyni tang da ki dur).

3. Ring da ka *protractor* ki angle kiba $\frac{1}{3}$ rt. \angle , $\frac{1}{2}$ rt. \angle , $\frac{2}{3}$ rt. \angle bad $\frac{1}{3}$ rt. \angle , shna pat da u *ruler* bad u *compasses* ki angle kiba ar shah ia ki. (Pyni tang da ki dur).

4. Ring da ka *protractor* ka angle kaba 120° bad shna da u *ruler* bad *compasses* ki angle kiba ar shah bad lai shah ia ka.

5. Ring da ka *protractor* ka angle kaba 72° bad shna da u *ruler* bad *compasses* ka angle kaba san shah ia ka.

6. Shna kawei ka angle **ABD** ha ujuh u lain **BD**, kaba kat ka angle **ABK**.

7. Ha u point **A** ha u lain **AB** shna ka angle **BAD** sha kawei pat ka liang u **AB** kaba kat ka angle **ABK**. U **AD** bad **BK** ki ialong kumno?

8. Ring kawei ka $\triangle \text{ABK}$. Pynjrong ia u **BK** sha u **D**. Shna ka $\angle \text{DKE}$ kaba kat ka $\angle \text{ABK}$. U **AB** bad **KE** ki ialong kumno?

9. Ring kawei ka $\triangle \text{ABK}$. Shna ka $\angle \text{AKD}$ shabar ka \triangle kaba kat ka $\angle \text{BAK}$. U **AB** bad **KD** ki ialong kumno?

10. Ring kawei ka $\triangle \text{ABK}$. Shna ka $\angle \text{BAD}$ shabar ka \triangle ban iaryngkat ia ka $\angle \text{B}$, bad ka $\angle \text{KAE}$ shabar ka \triangle , kat ka $\angle \text{K}$. U lain **DE** u long ne em uwei u lain bad u ialong kumno bad u lain **BK**?

22. KA JINGRING LAIN PARALLEL

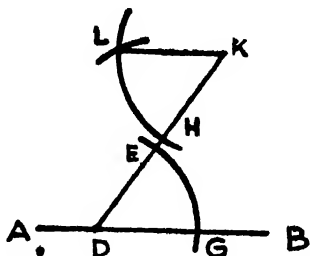
Problem 4

Lyngba jong uwei u point ring lain u ban parallel ia uwei pat u lain.

Lyngba u point **K** yn ring lain u ban parallel ia u lain **AB**.

Jingshnadur.-Shim uno uno u point **D** ha u **AB**.

Pyniasoh **KD**.



(Mynta ngin shna ka alternate \angle ha u **K** ka ban iaryngkat bad ka $\angle \text{KDB}$).

Na *centre* **D** bad da u *radius* uba duna ãa u **DK** ngi ring *arc* ban ot ãa u **DK** ha u **E** bad ãa u **DB** ha u **G**.

Na *centre* **K** bad da u *radius* **DG** ngi ring *arc* ban ot ãa u **KD** ha u **H**.

Na *centre* **H** bad da u *radius* **GE** ngi ring *arc* shaneng u **H** ban ot ãa kaba mynshuwa ha u **L**.

Pynñasoh **KL**.

Te u **KL** u long u lain uba parallel ãa u **AB**.

Jingpynshisha.—Namar ka $\angle \text{LKH} =$ ka alt $\angle \text{KDB}$.

\therefore u **LK** u long parallel ãa u **DB** lane **AB**.

La pyndep.

JINGPYRSHANG 41

(Ring tang ki dur ãa kine harum)

1. Buh point ar tylli **A** bad **B** kiba ãajngai 1". Ring uwei u lain **AK** u ban nym ãaid lyngba u **B** bad lyngba u pt **B** ring lain **BD** uba parallel ãa u **AK** (da u *ruler* bad *compasses*).

2. Shna ka $\angle \text{ABK}$ kaba 53° da ka *protractor*. Lyngba u pt **A** ring u lain **AD** uba parallel ãa u **BK** (da u *ruler* bad *compasses*).

3. Shna ka $\angle \text{ABK}$ kaba 90° da ka *protractor*. Lyngba u pt **A** ring u lain **AD** da u *ruler* bad *compasses* u ban parallel ãa u **BK**.

4. Shna ka $\angle \text{ABK}$ kaba 120° da ka *protractor*. Lyngba u pt **A** ring u lain **AD** da u *ruler* bad *compasses* ban parallel ãa u **BK**.

JINGPYRSHANG 42

1. Shna ka *equilateral* $\triangle ABK$. Ha u **AB** shna kawei pat ka *equilateral* $\triangle ABD$. U **AD** u iaparallel ne ém bad u **BK**? U **DB** de u iaparallel ne ém bad u **AK**? Ia kane ka dur phi khot ka dur aïu?

2. Shna ka isos $\triangle ABK$ ha kaba **AB** = **AK**. Ha u **AB** shna ka isos $\triangle ABD$ kaba kat ka $\triangle ABK$ ba u **AD** = **BK**. U **AD** u iaparallel ne ém bad u **BK**? Kane ka dei ka dur aïu?

3. Shna ka isos $\triangle ABK$ ha kaba u **AB** = **BK**. Ha u **AB** shna ka $\triangle BAD$ ba **AD** = **BK** bad **BD** = **AK**. Kane ka dur aïu?

4. Shna kano kano ka *scalene* $\triangle ABK$. Ha u **AB** shna ka $\triangle BAD$ kumta ba **BD** = **AK**, **AD** = **BK**. Kane ka dei ka dur aïu?

5. Shna kawei ka *right-angled* $\triangle ABK$, ka rt. \perp ha u **B**. Shna ka $\triangle AKD$ ba u **AD** = **BK**, **DK** = **AB**. Kane ka dei ka dur aïu?

23. KA JINGRING PERPENDICULAR NA U POINT BA HA U LAIN

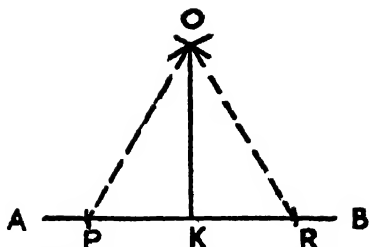
Problem 5

Ring perpendicular ha u lain na u point uba ha uta hi u lain ba la ai.

Ai ba **K** un long u point ha u lain **AB** ba la ai, bad yn ring u *perpendicular* ha u **AB** na u point **K**.

Jingshnadur.—

Na u **KA** bad **KB**
ot ar tylli kiba ã-
ryngkat, u **KP** bad
KR.



Na centre **P** bad **R**
bad da u radius **PR**
ring arc ar tylli shaneng u **AB**, bad ai kin ãaot ha u
point **O**.

Pyniasoh **KO**.

Te u **KO** u long *perpendicular* ha u **AB**.

Jingpynshisha.—Pyniasoh **OP**, **OR**.

Ha ki \triangle **OKP**, **OKR**.

(1) **KP** = **KR** (Kumba la leh haneng).

(2) **OR** u ãeng pdeng.

bad (3) **OP** = **OR**

(= **PR**, u radius jong ki \odot baroh ar).

\therefore ki \triangle ki ãaryngkat nadong shadong.

Kumta ba ka \angle **OKP** = ka \angle **OKR**.

Hynrei kine ki long ki adj \angle (baroh ar na ki
ki ãaryngkat lang 2 rt. \perp).

Kumta kawei kawei na ki ka long shi rt. \perp .

\therefore u **OK** u long perp ha u **AB**.

La pyndep.

Jingbatai lyngkot—(i) Lada u **K** u don
hajan eh ka tduh u **A** ne **B** jong u lain **AB**, shu pyn-
jrong noh shuwa ãa u **AB**.

(ii) Ha katei haneng ka \triangle **OPR** ka dei ka
equilateral \triangle . Kumjuh lah ban pynshisha lada pyn-

long ĩa ka **OPR** ka isos \triangle ha kaba pynryngkat ĩa u **OP** bad **OR**. Kata ha ka jaka ban shim da u *radius* **PR** kumba la shim, lah ban shim da uno uno u *radius* tang ba un palat khyndiat ĩa ka shiteng u **PR**.

JINGPYRSHANG 43

1. Ring u lain uba 3", bad ring u perp u ban don jngai 2" na ka tduh jong u lain.

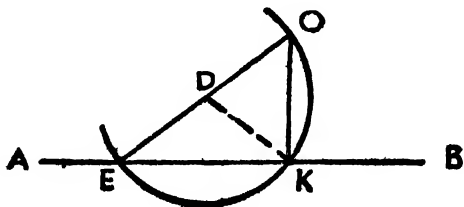
2. Ring ar tylli ki perp ha u lain uba 3'4" ; ki perp kin ĩajngai 2" bad 1" na ki tduh jong u.

3. Ring u lain **AB** uba 2" bad buh pt **O** ha shiteng u lain. Ot **OD** na u **OA** uba 6" bad **OE** na u **OB** uba 4". Na centre **D** bad **E** bad da u *radius* **DE** ring arc ban ĩapom ha u **K**. Pynĩasoh **KO**. U long u perp ne ěm ? Balei ?

4. Ring lain **AB** uba 2" bad buh pt **O** ha shiteng u lain. Na centre **A** ring arc da u *radius* uba 1'6". Bad na centre **B** ring arc da u *radius* uba 1'4". Ai kin ĩapom ha u **K**. Pynĩasoh **KO**. U long perp ne ěm ? Balei ?

KA BUIT SHNA DUR KA BAAR

Ai ba **K** un long u point uba ha u **AB** ha uba yn ring *perpendicular*.



Jingshnadur.—Shim uno uno u point **D** shaneng u lain **AB** shaphang kadiang khyndiat na u **K**.

Na *centre* **D** bad da u *radius* **DK** ring ka bynta jong ka *circle* ban ot ia u **AB** ha u **E**.

Pyniasoh **ED** bad pynjrong ban iakynduh ia ka bynta jong ka *circle* ha u **O**.

Pyniasoh **OK**.

Te u **OK** u long perp ha u **AB**.

Jingpynshisha—Pyniasoh **DK**.

Namar **DE = DK**, \therefore ka $\angle \mathbf{DEK} =$ ka $\angle \mathbf{DKE}$.

Namar **DO = DK**, \therefore ka $\angle \mathbf{DOK} =$ ka $\angle \mathbf{DKO}$.

\therefore ka $\angle \mathbf{DEK} +$ ka $\angle \mathbf{DOK} =$ ka $\angle \mathbf{EKO}$.

Hynrei ki \angle baroh lai jong ka \triangle ki = 2 rt \angle .

\therefore shiliang shiliang = 1 rt \angle .

\therefore ka $\angle \mathbf{EKO} =$ 1 rt \angle .

Kumta u **OK** u long perp ha u **AB**.

La pyndep.

(Ka angle ha ka *semi-circle* na ki tduh jong u diameter barobor ka long ka rt \angle)

KA BUIT SHNA DUR KABA LAI

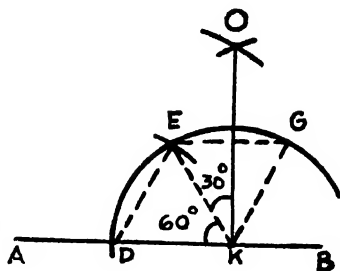
Ai ba **K** un long u point ha u **AB**, ha uba yn ring ia u *perpendicular*.

Jingshnadur—Shim uno uno u point **D** ha u **KA**.

Ha u **DK** shna ka *equilateral* \triangle **EDK**.

Ha u **EK** shna pat ka *equilateral* \triangle **EKG**.

Phiah ia ka \angle **EKG** da u **KO**.



Te u **KO** u long u *perp* ha u **AB**.

Jingpyنشisha.—Ki \angle ha ka *equilateral* \triangle ki long 60° kawei kawei.

\therefore ka \angle **DKE** $= 60^\circ =$ ka \angle **EKG**.

Hynrei ia ka \angle **EKG** la phiah da u **KO**.

Kumta ka \angle **EKO** $= 30^\circ$.

\therefore ka \angle **DKO** $= 60^\circ + 30^\circ = 90^\circ = 1$ rt \angle .

Kumta u **KO** u long u *perp* ha u **AB**.

La pyndep.

JINGPYRSHANG 44

1. Ring kano kano ka *semi-circle* (da u *compasses*). Ring lain na ki tduh u *diameter* ha uno uno u point ha ka *circumference*. Thew ia ki angle ha ka *semi-circle* ki long katno ka jingheh ?

2. Ring ka *circle* da u *radius* uba 1." Ring uwei u *diameter*. Shm kino kino ki point ha ka *circumference* bad ring lain ha ki tduh jong u *diameter*. Shem ia ka jingheh kita ki *angle* ha ka *circumference*.

3. Shna ka *equilateral* $\triangle ABK$ ha u lain uba 1'2". Na *centre* **A** bad u *radius* **AK** ring *circle*. Pynjrong ia u **BA** ban iakynduh ia ka *circle* na u **J**. Shem ia ka jingheh ka $\angle DKB$.

4. Shna ka *equilateral* $\triangle ABK$ ha u lain uba 1" Shna ka $\angle AKD$ shabar u **AK** kaba 30° . Pynjrong ia u **BK** sha u **E**. Shem ia ka jingheh ka $\angle DKE$.

5. Shna ka *equilateral* $\triangle AKB$ ha u lain uba 1'2". Pynjrong ia u **BA** sha u **D** kumta ba **BA=AD**. Pyniasoh **DK**. Shem ia ka jingheh ka $\angle DKB$.

6. Shna ka *equilateral* $\triangle ABK$ ha u lain uba 1'3". Shna sa kawei ka *equilateral* $\triangle AKD$ ha ujuh u lain **AK** kaba katjuh ka jingheh. Phiah ia ka $\angle AKD$ da u lain **KE**. Pynjrong **BK** sha u **G**. Shem ka jingheh jong ka $\angle EKG$.

7. Shna ka *equilateral* $\triangle ABK$ ha u lain uba 1". Phiah ia ka $\angle BAK$ marshiteng da u **AD** uba iakynduh ia u **BK** ha u **D**. Shem ia ka jingheh ka $\angle DAK$ bad ka $\angle AKD$.

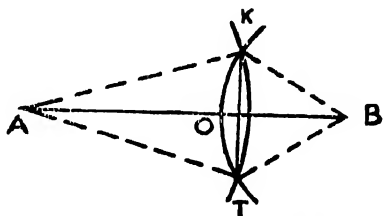
24. KA JINGRING PERPENDICULAR NA U POINT. BA NABAR U LAIN.

Problem 6

Ring perpendicular na u point uba shabar sha u lain ba la ai

Ai ba **K** un long u point bashabar ba yn ring
[erp sha u lain **AB** ba la ai.

Jingshnadur.—Na
centre **A** bad da u
radius **AK** ring arc
baroh arliang u **AB**.
Na centre **B** bad da
u radius **BK** ring sa
shisien ki arc baroh
arliang u **AB**. Kin ot ña kiba mynshuwa ha u **K** bad
T. Pynñasoh **KT** bad ai un ot ña u **AB** ha u **O**.



Te u **KO** u long perp ha u **AB**.

Jingpynshisha.—Pynñasoh **AK**, **AT**, **BK**,
BT.

Ha ki $\triangle KAB$, TAB .

- (1) **AK** = **AT** (ki radius jong kajuha ka \odot)
- (2) **BK** = **BT** (ki radius jong kawei pat ka \odot).
- (3) **AB** u ñeng pdeng.

\therefore ka $\angle KAB$ = ka $\angle TAB$.

Kumjuh ha ki $\triangle KAO$, TAO .

- (1) **AK** = **AT**.
- (2) **AO** u ñeng pdeng.
- (3) ka included $\angle KAO$ = ka included $\angle TAO$

∴ ki \triangle ki iaryngkat nadong shadong.

Kumta ba ka $\angle \mathbf{KOA} = \text{ka } \angle \mathbf{TOA}$.

Hynrei kine ki long ki adj \angle , kiba iaryngkat
2 rt | .

Kawei kawei ka dei ban long ka rt \perp .

∴ ka $\angle \mathbf{KOA}$ ka long ka rt \perp .

Kumjuh ka $\angle \mathbf{KOB}$ ruh ka long ka rt \perp .

∴ u \mathbf{KO} u long u perp ha u \mathbf{AB} .

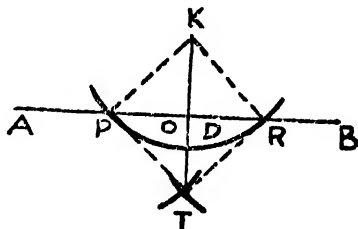
La pyndep.

KA BUIT SHNA KA BAAR

Ai ba \mathbf{K} un long u point bashabar ta yn ring
perpendicular ha u lain ba la ai.

Jingshnadur.—

Shim uno uno u point
 \mathbf{D} harud u \mathbf{AB} bad ha
ka liang bajngai na
u \mathbf{K} .



Na *centre* \mathbf{K} , bad
da u *radius* \mathbf{DK} , ring
circle ban ot ia u \mathbf{AB} ha ki point \mathbf{P} bad \mathbf{R} .

Na ki *centre* \mathbf{P} bad \mathbf{R} bad da ujuh u *radius* \mathbf{PK}
ring biang ki *arc* ban ot ha u point \mathbf{T} , sha ka liang
bamarpyrshah ia u \mathbf{K} .

Pyniasoh \mathbf{KT} bad ai ba yn ot ia u \mathbf{AB} ha u \mathbf{O} .

Te u \mathbf{KO} u long perp ha u \mathbf{AB} .

Jingpynshisha.—Pyniasoh $\mathbf{KP}, \mathbf{KR}, \mathbf{PT}, \mathbf{RT}$.
Ha ki $\triangle \mathbf{PKT}, \mathbf{RKT}$.

(1) $\mathbf{KP} = \mathbf{KR}$, (ki *radius* jong kajuha ka \odot).

(2) $\mathbf{PT} = \mathbf{RT}$ ($= \mathbf{KD}$ u *radius* jong ki \odot
baaryngkat).

(3) **KT** u ieng pdeng.

Kumta ki \triangle ki iaryngkat nadong shadong.

\therefore ka \angle **PKT** = ka \angle **RKT** (kata ba ka \angle **PKO** = ka \angle **RKO**).

Kumjuh ha ki \triangle **PKO**, **RKO**.

(1) **KP** = **KR**.

(2) **KO** u ieng pdeng.

(3) ka \angle **PKO** = ka \angle **RKO** (la pyni haneng).

Kumta ba ki \triangle ki iaryngkat nadong shadong.

\therefore ka \angle **KOP** = ka \angle **KOR**.

Hynrei kine ki long ki angle baamarjan, ki baaryngkat lang 2 rt \perp ; kumta ba kawei kawei ka angle ka long ka rt \perp .

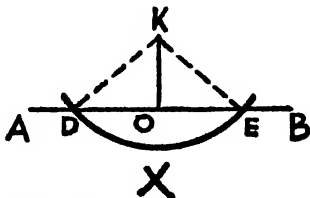
\therefore u **KO** u long u perp ha u **AB**.

La pyndep.

KA BUIT SHNA DUR KA BALAI

Ai ba u **AB** un long u lain, bad **K** un long u point bashabar u lain, na uba yn ring *perpendicular* ha une u lain **AB**.

Jingshnadur—Na centre **K** bad da u *radius* uba jrong kat ban biang ban ot ia u **AB** ha ki ar jaka, ring *arc* bad ai kan ot ia u **AB** ha u **D** bad u **E**.



Ot marshiteng ia u **DE** ha u **O**.

Pyniasoh **KO**.

Te u **KO** u long uta u perp.

Jingpynshisha.—Pyniasoh **KD**, **KE**.

Ha ki \triangle **KOD**, **KOE**.

Namar ba (1) **KD** = **KE**.

(2) **KO** u ieng pdeng.

(3) **DO** = **OE**.

\therefore Kine ki \triangle ki iaryngkat nadong shadong.

Kumta ba ka \angle **KOD** = ka \angle **KOE**.

Hynrei kine ar tylli ki \angle ki = 2 rt \perp .

Kumta kawei kawei na ki ka = shi rt \perp .

\therefore u **KO** u long perp ha u **AB**.

La pyndep.

JINGPYRSHANG 45

1. Shna kawei ka *right-angled* \triangle bad ring perp na ka rt \perp ha u hypotenuse.

2. Shna kano kano ka *acute-angled* \triangle bad ring perp na ki \angle ha ki lain baipyrrshah. Shem hangno ki perp ki iakynduh. (Pyni tang da ka dur).

3. Shna kawei ka *obtuse-angled* \triangle bad ring perp na ki \angle ha ki lain baipyrrshah. Shem hangno ki perp kin iakynduh. (Pyni tang da ka dur).

4. Shna kawei ka *right-angled* \triangle bad ring perp na ki \angle ha ki lain baipyrrshah. Shem hangno ki perp kin iakynduh. (Pyni tang da ki dur).

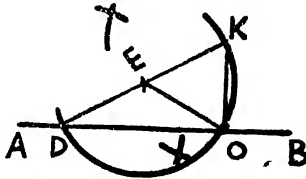
La 'a' point ba shabar u don shan eh ka tduh jong u lain, lah ban shu pynjrong ia u lain, lue, da kumne nator ka buit shna ba la ai mynshuwa.

KA BUIT SHNA KA BASAW

Ai ba **K** un long u point bashabar ba yn ring perp ha u lain **AB** ba la ai.

Jingshnadur.—Shim uno uno u point **D** ha u **AB**, kham jngai na u **K**.

Pyniasoh **DK**.

Ot marshiteng, ia u **A D**  **B** ha u **E**.

Na centre **E** bad u radius **ED** ne **EK** ring circle ban ot ia u **AB** ha u **O**.

Pyniasoh **OK**.

Te u **KO** u long perp ha u **AB**.

Jingpynshisha.—Pyniasoh **EO**.

Namar **ED = EO** \therefore ka $\angle \text{EDO} = \text{ka } \angle \text{EOD}$.

Namar **EK = EO** \therefore ka $\angle \text{EKO} = \text{ka } \angle \text{EOK}$.

\therefore ki $\angle \text{EDO} + \text{ka } \angle \text{EKO} = \text{ka } \angle \text{KOD} = 1 \text{ rt } \angle$

Namar lai tylli ki \angle jong ka \triangle ki $= 2 \text{ rt } \angle$.

Shiliang shiliang ki dei ban long $1 \text{ rt } \angle$.

\therefore U **KO** u long perp ha u **AB**.

La pyndep.

(Hangtei ngi ring u diameter **DK** bad ka semi-circle **DOK**, kumta ba ka $\angle \text{KOD} = 1 \text{ rt } \angle$.)

JINGPYRSHANG 46

1. Shna kawei ka $\text{rt } \perp \text{d } \triangle \mathbf{ABK}$ kaba long $\text{rt } \perp$ ha u \mathbf{K} . Ot ia u \mathbf{AB} marshiteng ha u \mathbf{O} . Na *centre* \mathbf{O} bad u *radius* \mathbf{OA} ring *circle*. Kane ka \bigcirc ka ïaid lait ne ém lyngba u pt \mathbf{K} ?

2. Ring u diameter \mathbf{AB} . Ot ia u marshiteng ha u pt \mathbf{O} . Ring ka \bigcirc da u diameter \mathbf{AB} bad ka *centre* \mathbf{O} . Shim ki pt \mathbf{K} hangno hangno ha ka \bigcirc ce. Ka $\angle \mathbf{AKB}$ ka heh katno? Thew.

3. Shna ka isos $\triangle \mathbf{ABK}$, kumta ba $\mathbf{AB} = \mathbf{AK}$. Pynjrong ia u \mathbf{BA} sha u \mathbf{O} , kumta ba $\mathbf{BA} = \mathbf{AO}$. Pyniasoh \mathbf{OK} . Ka $\angle \mathbf{OKB}$ ka heh katno?

4. Ring kawei ka \bigcirc . Ring u diameter na lyngba sha'lyngba. Shim ar tylli kino kino ki pt ha ka \bigcirc ce ha baroh ar liang jong u diameter. Na kine ki pt ring lain ha ki tduh jong u diameter. Kine ki \angle ha ka \bigcirc ce ki ïaryngkat ne ém? Ki ïahch mar katno?

5. Ring u lain \mathbf{AB} bad buh pt \mathbf{K} habar u lain. Shim kino kino ar tylli ki pt \mathbf{P} bad \mathbf{R} ha u lain \mathbf{AB} . Na *centre* \mathbf{P} bad u *radius* \mathbf{PK} ring *arc* baroh ar liang u \mathbf{AB} . Na *centre* \mathbf{R} bad da u *radius* \mathbf{RK} ring *arc* biang baroh ar liang u \mathbf{AB} . Ai kin ot ha u \mathbf{T} . Pyniasoh \mathbf{KT} . U \mathbf{KT} u long u perp ne ém ha u \mathbf{AB} ?

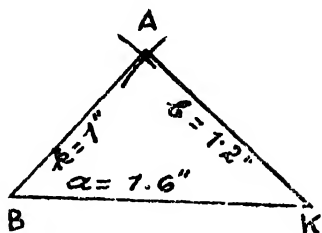
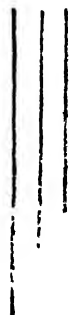
25. KA JINGSHNA TRIANGLE

(Ha ka jingïadei ki lain bad ki angle jong ki \triangle khmih biang pej 36 Bynta I bad pej 59 Bynta II).

Problem 7.

Shna ka triangle kat kum ki lain ba la ai-
 $a=1.6''$, $b=1.2''$, $k=1''$.

$a \ b \ k$



a , b , bad k ki long ki lain ba la ai.

Ngin shna ka triangle kaba don ki lain kiba
 iaryngkat ia kine lai tylli, a , b bad k .

Jingshnadur.—Ring u lain **BK** kat u a . Na
centre **B** bad u *radius* uba kat u k , ring arc shaneng u
BK. Na *centre* **K** bad *radius* kat u b , ring arc biang
 ban ot ia kaba mynshuwa ha u **A**.

Pyniasoh **AB**, **AK**.

Te **ABK** ka long ka \triangle ba la kwah ia ka ban
 shna.

Jingpynshisha.—Namar **BK** = a , **AK** = b ,
AB = k .

La pyndep.

Jingbthah.—U lain a u iäpyrshah iä ka $\angle A$, u b iä ka $\angle B$ bad u k iä ka $\angle K$. Shuwa ban shna ka bapaka leh lypa i bamalu mala harud bad buh kyrteng lypa ban nym bakla bad shitom pat hadien.

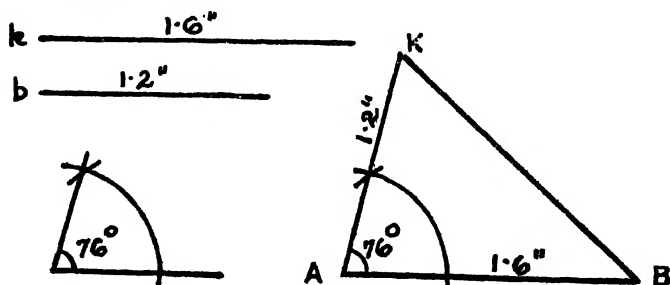
JINGPYRSHANG 47

1. Shna triangle kat kum kine ki lain harum, bad iathuh ki dei ki triangle aü :—

- (i) $a = 1.5''$, $b = 1.5''$, $k = 1.5''$.
- (ii) $a = 2''$, $b = 1.2''$, $k = 1.2''$.
- (iii) $a = 2.5''$, $b = 2''$, $k = 1.5''$.
- (iv) $a = 1''$, $b = 2''$, $k = 1.5''$.
- (v) $a = 2''$, $b = 3\text{cm}$, $k = 2\text{cm}$.
- (vi) $p = 1.3''$, $r = 2.3\text{cm}$, $s = 23\text{mm}$.
- (vii) $l = 2''$, $m = 5\text{cm}$, $n = 25\text{mm}$.

Problem 8.

Shna triangle kat kum ki ar tylli ki lain ba la ai bad kaba don ka angle ba la ker da ki (ka included angle) kaba kat kaba la ai, $b = 1.2''$, $k = 1.6''$, $\angle A = 76^\circ$.



Yn shna ka triangle kaba don ar tylli ki lain b uba $= 1.2''$, k uba $= 1.6''$ bad ka included $\angle A$ kaba $= \angle R$ kaba $= 76^\circ$.

JINGPYRSHANG 49

1. Shna triangle kaba don u lain, bad ki angle ha ki tduh jong u ba kin long kat kine harum :— Iathuh de ki dei ki triangle aïu kine ?

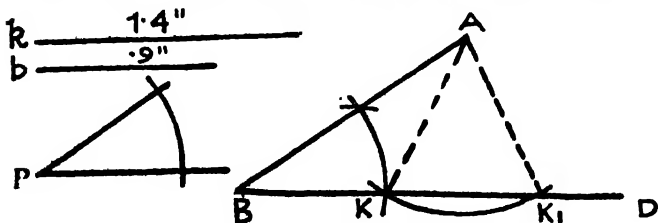
- (i) $a = 1.5''$, $\angle B = \angle K = 45^\circ$.
- (ii) $b = 3\text{cm}$, $\angle A = 30^\circ$, $\angle K = 60^\circ$.
- (iii) $k = 2''$, $\angle A = 60^\circ$, $\angle B = 60^\circ$.
- (iv) $a = 3.2\text{cm}$, $\angle B = 90^\circ$, $\angle K = 90^\circ$.

2. Shna ka triangle ha u lain uba $1.2''$ kaba ki angle baroh lai ki ñaryngkat.

3. Shna ka isos \triangle ha u lain uba 3cm , kawei na ki angle baïaryngkat ha tduh unc u la n ka long 50° . Shem ña ka \angle kaba lai.

Problem 10.

Shna ka triangle kat kum ki ar tylli ki lain ba la ai bad ka angle kaba pyrrshah ña uwei na ki kat ka angle ba la ai.



Ai ba u k bad u b ki long ki lain ba la ai bad **P** ka angle ba la ai.

La kwah ban shna ka triangle kaba don ar tylli ki lain kat u k bad u b, bad ka ang'e bapyrrshah ña uwei na ki kat ka \angle **P**.

Jingshnadur—Ring uwei u lain **BD**.

Ha u point **B** ha u lain **BD** shna ka angle **DBA** ka baïaryngkac ãa ka \angle **P**.

Pynlong ãa u **BA** kat u k.

Na centre **A** bad u radius uba kat u b, ring arc.

Lada kane ka arc ka ot ar jaka ãa u **BD**, buh **K** bad **K₁**.

Pynñasoh **AK** bad **AK₁**.

Te **ABK** ne **ABK₁** ka long kata ka triangle.

Jingpynshisha—

Namar **AB** u = k, **AK** u = **AK₁** u = b,

bad ka \angle **B** kaba pyrshah ãa u **AK**

ne **AK₁** ka = \angle **P**.

\therefore ka **ABK** ne **ABK₁** ka long kata ka \triangle .

La pyndep.

Jingbatai—Lada—

(i) u b u paht ãa u k, kan mih ka *scalene* \triangle .

(ii) u b = u k, kan mih ka *isos* \triangle .

(iii) u b = u perp na u **A** ha u **BD**, kan mih ka rt \angle ed \triangle .

(iv) u b u duna ãa u perp na u **A** ha u **BD**, kan nym long \triangle .

(Thew hi da lade bad pynshisha ka long kumta ne em ?)

JINGPYRSHANG 50

Shna ka triangle kat kum ki ar tylli ki lain ba la ai bad ka angle baïapyrshah ãa uwei na ki kat ka angle ba la ai harum :—

lathuh ki dei ki \triangle aũu ?

(i) b = 2", k = 1", \angle **B** = 45°.

(ii) b = 2" = k, \angle **K** = 53°.

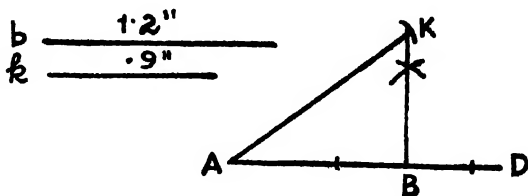
(iii) a = 1.5", k = 2.6", \angle **A** = 36°.

(iv) a = 2", b = 2.8", \angle **A** = 45°.

- (v) $a = 3\text{cm}$, $b = 2.5\text{cm}$, $\angle A = 75^\circ$.
 (vi) $a = 2.4\text{cm}$, $b = 2.4\text{cm}$, $\angle B = 60^\circ$.
 (vii) $b = 5\text{cm}$, $k = 3\text{cm}$, $\angle K = 60^\circ$.

Problem 11.

Shna ka right-angled triangle haba la ai uwei u lain bad u hypotenuse.



Ai ba u b un long ka jingjrong u *hypotenuse* bad k jong uwei pat u lain ba la ai.

Jingshnadur—Ring u lain **AD** bad na u **AD** ot **AB** kat u k.

Ha u **B** ha u **AD** ngi ring perp **BK**.

Na centre **A** bad da u *radius* ba kat u b ngi ring arc ka ban ot ia u perp ha u **K**.

Pyniasoh **AK**.

Te **ABK** ka long kata ka triangle.

Jingpynshisha—Namar **AB** = k , **AK** = b , bad ka $\angle \mathbf{ABK} = \text{rt } \angle$.

\therefore ka $\triangle \mathbf{ABK}$ ka long kata ka \triangle ba la kwah ban shna.

La pyndep.

JINGPYRSHANG 51

Shna ka *right-angled triangle* kat kum u lain bad u *hypotenuse* ba la ai ha kine harum :—

- (i) $2.2''$, $3.1''$. (ii) 5cm , 7cm . (iii) 3cm , 5cm .
 (iv) 4cm , 4cm .

Problem II.

KAWEI PAT KA RUKOM SHNA DUR

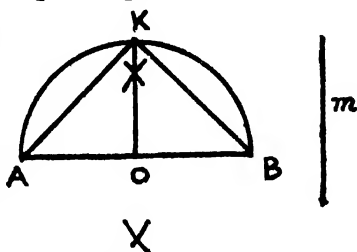
Ai ba **AB** u long u *hypotenuse*, bad m u long lain.

Jingshnadur—Ngin shna ka *semi-circle* ha diameter **AB**.

Ot ia u **AB** marshiteng ha u point **O**.

Na *centre* **O** bad da u *radius* **OA** ne **OB** ngi ring ka *semi-circle* ha u diameter **AB**.

Na *centre* **A** bad da u *radius* kat u m ngi ring *arc* ban ot ia ka *semi-circle* ha u **K**.



Pyniasoh **AK, KB**.

Te **ABK** ka long ka \triangle ba la kwah 'ban shna.

Jingpynshisha—Pyniasoh **OK**.

Namar **OA = OK** \therefore ka $\angle \text{OAK} = \text{ka } \angle \text{OKA}$.

Namar **OB = OK** \therefore ka $\angle \text{OBK} = \text{ka } \angle \text{OKB}$.

\therefore ka $\angle \text{OAK} + \text{ka } \angle \text{OBK} = \text{ka } \angle \text{AKB}$.

Hynrei baroh lai ki $\angle \text{ki} = 180^\circ$.

Kumta shiliang shiliang ki ialong 1 rt \angle .

Kumta ba **ABK** ka long ka *right-angled triangle* ha u *hypotenuse* **AB** bad ha kaba u **AK = m**.

La pyndep.

JINGPYRSHANG 52

1. Ring *semi-circle* ha u diameter **AB**. Shim uno uno u point **K** ha ka *circumference*. Pynshisha ba ka $\angle \text{AKB}$ ka long barobor ka rt \angle .

2. Ha ka dur haneng pyni ba—

(i) ka $\angle \mathbf{OAK} + \text{ka } \angle \mathbf{OKA} = \text{ka } \angle \mathbf{KOB}$.

(ii) ka $\angle \mathbf{OBK} + \text{ka } \angle \mathbf{OKB} = \text{ka } \angle \mathbf{AOK}$.

3. Ha ka dur haneng lada ka $\angle \mathbf{OAK}$ ka long 60° .

Pyni ba (i) ka $\angle \mathbf{AOK} = \text{ka } \angle \mathbf{OKA} = 60^\circ$.

(ii) ka $\angle \mathbf{OBK} = \text{ka } \angle \mathbf{OKB} = 30^\circ$.

4. Ha uwei u *hypotenuse* uba 5cm, shna ka *right-angled* \triangle kaba don ki angle kiba 30° bad 60° .

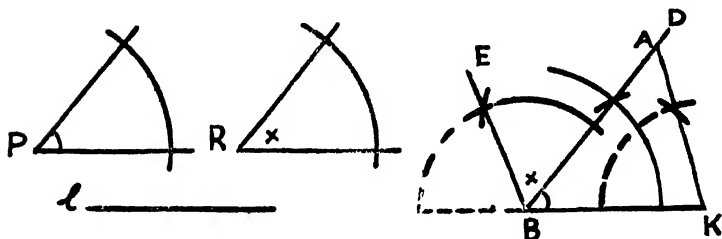
(P'yniaryngkat ia u \mathbf{AK} bad u \mathbf{AO} ha ka dur haneng.)

5. Ha u *hypotenuse* uba 2", shna ka *rt-angled* \triangle kaba don ki \angle kiba 45.

(Ring perp \mathbf{KO} ha u \mathbf{O} ha ka dur haneng).

Problem 12.

Shna ka triangle haba la ai ar tylli ki angle bad uwei u lain baäpyrshah ia kawei na ki.



Ai ba \mathbf{P} bad \mathbf{R} ki long ki ar tylli ki \angle ba la ai, bad l uwei na ki lain baäpyrshah ia kawei na ki.

Jingshnadur—Ring u lain \mathbf{BK} uba kat u l.

Ha u point \mathbf{B} ha u \mathbf{BK} shna ka $\angle \mathbf{KBD}$ kaba kat ka $\angle \mathbf{P}$.

Ha u point **B** ha u **BD** shna ka \angle **DBE** kaba kat ka \angle **R**.

Lyngba u **K** ring lain **KA** uba parallel ia u **BE** bad ai un ot ia u **BD** ha u **A**.

Te ka **ABK** ka long ka \triangle ba la kwah ia ka ban shna.

Jingpynshisha—Namar u **BE** u long parallel ia u **KA**.

\therefore ka \angle **BAK** ka = ka alt. \angle **ABE** ka = ka \angle **R**.

Ruh ka \angle **ABK** ka = ka \angle **P**.

Bad u **BK** uba pyrshah ia ka \angle **A** u iaryngkat ia u l.

La pyndep.

Jingbatai lyngkot—Lah ruh ban shna (i) da kaba pynjrong ia u **BK** sha u **M** bad sa shna ka \angle **MKN** kat ka \angle **P** bad ka \angle **NKA** kat ka \angle **R**, bad ia ka \angle **KBA** kat ka \angle **P**.

Lane (ii) Shna lang ia ka \angle **P** bad \angle **R** ban ialong lang hajan baroh ar liang uwei u lain, bad shem ia ka jingheh ka supplement kaba iadei lang ia ki baroh ar. Nangta shna ka \angle **BKA** kat kata ka supplement bad ka \angle **KBA** kat ka \angle **P**.

JINGPYRSHANG 53

Shna ka triangle kat kum kine ki angle ba la ai, bad kaba don u lain uba pyrshah ia kawei na ki, kat uba la ai harum :—

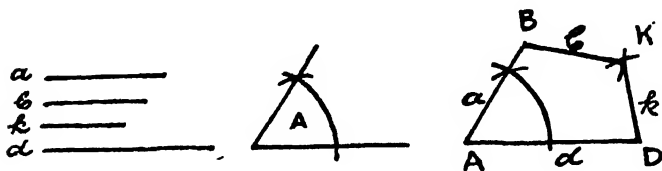
(i) $60^\circ, 90^\circ, 1'1''$. (ii) $75^\circ, 60^\circ, 1'3''$. (iii) $30^\circ, 45^\circ, 4'1\text{cm}$. (iv) $100^\circ, 80^\circ, 3\text{cm}$.

26. KA JINGSHNA IA KI QUADRILATERAL

Ngi la iohi ba haba shna ia ki triangle donkam lai tylli kiei kiei ba la ai, hynrei ha ka *quadrilateral* donkam la kumno kumno san.

Problem. 13.

Shna ka quadrilateral, haba la ai ka jingjriong jong saw tylli ki lain bakér bad kawei ka angle.



Ai ba a , b , k bad d kin long ka jingjriong jong saw tylli ki lain bakér bad **A** ka angle ba hapteng ki lain bakér u a bad d .

Jingshnadur.—Shim u lain **AD** uba kat u d .

Shna ka \angle **BAD** kat ka \angle **A** bad pynlong ia u **AB** kat u a .

Na ki centre **B** bad **D** bad ki radius b bad k ring arc ar tylli ban iapom ha u **K**.

Pyniasoh **BK**, **DK**.

Te **ABKD** ka long kata ka *quadrilateral*.

Jingpynshisha.—Na ka jingshnadur, u **AB** = a , **BK** = b , **KD** = k , **AD** = d bad ka \angle **BAD** = ka \angle **A**.

La pyndep.

JINGPYRSHANG 54.

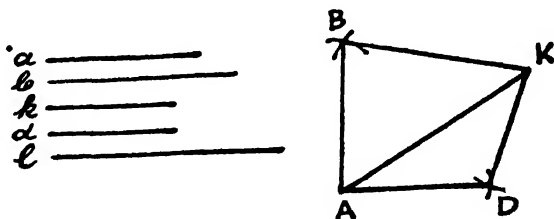
1. Shna ka *quadrilateral* haba la ai $AB = 1.5''$, $BK = 2.2''$, $KD = 1.3''$, $DA = 1''$ bad ka $\angle B = 70^\circ$.

2. Shna ka *quadrilateral* haba la ai $AB = 3.5\text{cm}$, $BK = 5.6\text{cm}$, $DA = 6.3\text{cm}$ bad ka $\angle A = 110^\circ$, ka $\angle D = 70^\circ$.

3. Shna ka *quadrilateral* haba la ai $AB = 1.2''$, $AD = 2.7''$, $\angle A = 60^\circ$, $\angle B = 100^\circ$, $\angle D = 80^\circ$.

Problem 14.

Shna ka *quadrilateral*, haba la ai \bar{a} ka jingjrong jong ki saw tylli ki lain baker \bar{a} ka, bad \bar{a} u diagonal.



Ai ba a , b , k bad d ki long ki jingjrong jong ki saw tylli ki lain baker bad l , ka jingjrong jong u diagonal.

Jingshnadur :—Ring u diagonal AK ba kat u l .

Shim centre na u A bad na u K bad da ki radius pat kat u a bad b , la ka jong ka jong, ring arc ar tylli sha ka liang ka diang jong u AK ban iapom ha u B .

Nangta shim centre biang na u K bad na u A

bad da ki *radius* pat kat u k bad d, la ka jong ka jong, ring *arc* biang ar tylli sha ka liang kamong jong u **AK** bad ai kin fapom ha u **D**.

Pyniasoh **AB, BK, AD, KD**.

Te **ABKD** ka long kata ka *quad* ba la shna.

Jingpynshisha :—Na ka jingshnadur, **AB** = a, **BK** = b, **KD** = k bad **AD** = d bad u diagonal **AK** = l.

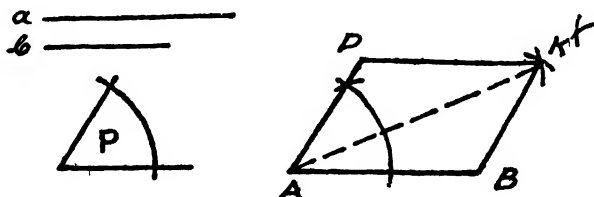
JINGPYRSHANG 55

1. Shna ka *quadrilateral* haba la ai kaba don katne ki lain bakér òa ka 1", 1.2", 1.4", 1.6" bad uwei na ki diagonal 1.8".

2. Shna ka *quadrilateral* haba la ai òa ka jingjrong lai tylli ki lain bakér kiba òaryngkat 1.2", 1.2" bad 1.5" bad òa ka jingjrong ki diagonal 1.6" bad 1.8".

Problem 15

Shna ka *parallelogram*, haba la ai òa ki ar tylli ki lain ker bañamarjan bad ka angle ba la kynthup da ki.



Ai ba a bad b kin long ka jingjrong ki ar tylli ki lain bakér bad ka $\angle P$ ba hapdeng jong ki.

Jingshnadur.—Ring u lain **AB** uba kat u a.

Shna ka \angle **BAD** kat ka \angle **P**, da pynlong ãa u **AD** pat kat u b.

Na ki *centre* **D** bad **B** bad da ki *radius* pat kat u **AB** bad **AD**, la ka jong ka jong, ring *arc* ar tylli ki ban ãapom ha u point **K**.

Pyniasoh **DK**, **BK**.

Te **ABKD** ka long kata ka parallelogram ba la shna

Jingpynshisha.—Pyniasoh **AK**.

Ha ki \triangle **ABK**, **ADK**, **AB** = **DK**,
BK = **AD** bad **AK** u ãeng pdeng.

\therefore Kine ki \triangle ki ãaryngkat nadong shadong.

Kumta ba ka \angle **AKB** - ka \angle **KAD**.

Bad ka \angle **KAB** = ka **DKA**.

Hynrei kine ki long ki ar jur jong ki alt \angle .

Kumta ba u **AD** u ãaparellel ãa u **BK**.

Bad u **AB** u ãaparellel ãa u **DK**.

\therefore Ka dur **ABKD** ka long ka parallelogram.

Bad u **AB** = **DK** = a, **AD** = **BK** = b, bad
ka \angle **DAB** = ka \angle **P**.

La pyndep.

JINGPYRSHANG 56

1. Shna ka parallelogram, haba la ai **AB** = 2".
AD = 1", bad ka \angle **BAD** = 60° .

2. Shna ka parallelogram, haba la ai **AB** = 3cm,
AD = 1.5cm bad u diagonal **BD** = 4cm.

Shna ka *rectangle*, haba la ai **AB** = 4cm,
AD = 3cm.

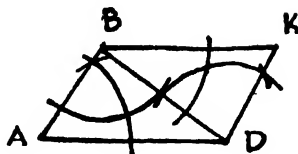
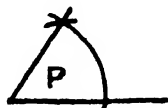
Problem 15

KA RUKOM SHNA KA BAAR

Shna ka parallelogram, haba la ai ar tylli ki lain ker ba rajan bad ka angle ba la pynlong da ki.

a —————

b —————



Ai ba a bad b ki long ka jingjrong ba la ai ia ki ar tylli ki lain ba ker ba iamarjan bad P ka angle ba la ai.

Jingshnadur.—Ring u lain AD uba kat u a .
Ha u A shna ka $\angle BAD$ kaba kat ka $\angle P$.
Pynlong ia u AB kat u b .

Pyniasoh BD .

Ha u B bad D ring ki lain BK bad DK ban iaparallel ia u AD bad AB .

Ai kine ki lain kin iakynduh ha u K .

Te $ABKD$ ka long kata ka iaparallelogram.

Jingpynshisha.—Na ka jingshnadur, ka $ABKD$ ka long ka par^m.

U $AD = a$, u $AB = b$ bad ka $\angle BAD = \angle P$.

La pyndep.

Jingbatai lyngkot:—Haba ring lain **BK** ban parallel ia u **AD**, ngi shna ka alt \angle **DBK** kat ka \angle **BDA**. Bad da 'kaba shna ka \angle **BDK** kat ka \angle **ABD**, u **DK** u parallel ia u **AB**.

JINGPYRSHANG 57

1. Shna parallelogram, haba la ai **AB** = 2cm, u **AD** = 3cm bad ka \angle **A** = 30° .

2. Shna ka parallelogram haba la ai **AD** = 1'5", u **DK** = 1" bad u diagonal **AK** = 2".

Problem 16.

Shna ka square ha u lain beiti ba la ai

Ai ba u **AD** u long u lain beiti ba la ai, ha uba ia ka square yn shna.

Jingshnadur—Na u **A**, ring **AB** ban long perp ha u **AD** bad pynias-ryngkat ia u **AB** bad u **AD**.

Na centre **B** bad **D** bad da ujuh u radius kat u **AD** ring arc ar tylli ban iapom ha u point **K**.

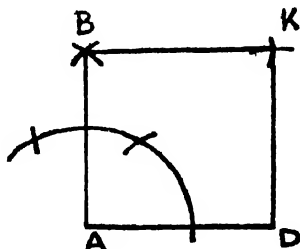
Pyniasoh **BK**, **DK**.

Tc **ABKD** ka long kata ka square.

Jingpynshisha—Pyniasoh **BD**.

Ha ki \triangle **KBD**, **ABD**.

(i) **BK** = **AD**, (ii) **KD** = **AB**, (iii) **BD** u ieng pdeng.



\therefore ki \triangle ki iaryngkat nadong shadong.
Kumta ba ka $\angle \mathbf{KBD} = \text{ia ka } \angle \mathbf{BDA}$.

bad ka „ $\mathbf{KDB} = \text{ia ka } \mathbf{ABD}$.

Hynrei kine ki long ki alt \angle .

Kumta u \mathbf{BK} u par^l ia u \mathbf{AD} , u \mathbf{KD} ia u \mathbf{AB} .

Kumta ka \mathbf{ABKD} ka long ka par^m.

Bad ka $\angle \mathbf{BAD}$ ka long ka rt \angle .

Kumta ka long ka *rectangle*.

Nangta ki lain baamarjan, u \mathbf{AB} bad \mathbf{AD} ruh ki iaryngkat.

\therefore ka \mathbf{ABKD} ka dei ka *square*.

La pyndep.

Problem 16.

KA BUIT SHNA KA BAAR

Shna ia ka square ha u lain beit ba la ai.

Ai ba \mathbf{AD} u long u lain
beit ba la ai ha uba ia ka
square yn shna.

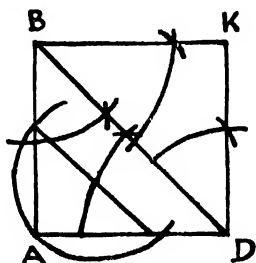
Jingringdur—Ha u \mathbf{A}
jong u \mathbf{AD} ring u perp \mathbf{AB}
uba kat u \mathbf{AD} .

Pyniasoh \mathbf{BD} .

Lyngba u \mathbf{B} ring lain
 \mathbf{BK} ban parallel ia u \mathbf{AD} da
kaba pynlong ka $\angle \mathbf{DBK}$ kat ka $\angle \mathbf{BDA}$.

Lyngba u \mathbf{D} ring lain \mathbf{DK} ban parallel ia u \mathbf{AB}
da kaba pynlong ka $\angle \mathbf{BDK}$ kat ka $\angle \mathbf{ABD}$.

Ai u \mathbf{BK} bad \mathbf{DK} kin iakynduh ha u point \mathbf{K} .
Te \mathbf{ABKD} kan long kata ka *square*.



Jingpynshisha—Namar u **BK** u par^l ia u **AD**, u **KD** ia u **AB**.

Ka **ABKD** ka long ka par^m.

Namar ka \angle **BAD** ka long ka rt \perp .

\therefore ka **ABKD** ka long ka *rectangle*.

Namar u **AB** = **AD**, ki lain baiamarjan.

\therefore ka **ABKD** ka long ka *square*.

La pyndep.

JINGPYRSHANG 58

1. Shna ka *square* ha u lain uba 1".

2. Shna ka *square* ba uwei uwei na ki diagonal u long 4cm.

Buit :--Ki diagonal jong ka *square* ki iaryngkat ; ki iaot uwei ia uwei ha marshiteng bad ki pynlong ki rt \perp .

27. KI JINGRING PERPENDICULAR HA KI CIRCLE

Problem 17.

Ring perpendicular ha marshiteng jong u chord jong ka circle.

Ai ba **AB** u long u *chord* jong ka \odot ha kaba u **O** u long ka *centre*.

La kwah ban ring perp ha u shiteng jong u **AB**.

Jingshnadur—Ot mar-shiteng ña u **AB** ha u **D**.

Pynñasoh **OD**.

Te u **OD** u long uta-u *perpendicular*.

Jingpynshisha—Pynñasoh **OA**, **OB**.

Ha ki \triangle **ODA**, **ODB**.

(i) **AD** = **BD**. (ii) **OD** u ñeng pdeng.

(iii) **OA** = **OB**.

\therefore ki \triangle ki ñaryngkat nadong shadong.

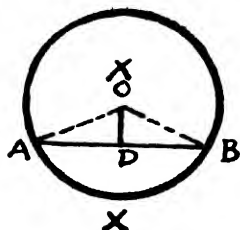
Kumta ba ka \angle **ODA** = ka \angle **ODB**.

Hynrei kine ki ar tylli ki \angle = 2 rt \angle .

\therefore kawei kawei ka long shi rt \angle .

Kumta ba u **OD** u long perp ha u **AB**.

La pyndep.



Problem 18.

Ring perpendicular na ki pdeng jong ki chord

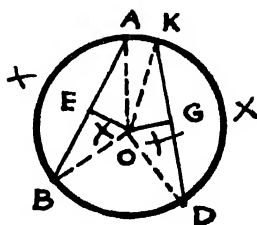
Ai ba **O** ka long ka *centre* jong ka *circle*, ha kaba u **AB** bad **KD** ki long ki *chord*.

La kwah ban ring perp ha ki shiteng jong u **AB** bad **KD**.

Jingshnadur—Ot mar-shiteng ña u **AB** ha u **E** bad ña u **KD** ha u **G**.

Pynñasoh **OE**, **OG**.

Te u **OE** bad u **OG** ki long kisa ki perp.



Jingpynshisha—Pynñasoh **OA, OB, OK, OD.**

Ha ki $\triangle OEA, OEB.$ (i) $AE = EB.$
 (ii) OE u ñeng pdeng. (iii) $OA = OB.$

\therefore ki \triangle ki ñaryngkat nadong shadong.

Kumta ba ka $\angle OEA =$ ka $\angle OEB.$

Hynrei kine baroh ar ki $= 2$ rt $\angle.$

Kumta ba kawei kawei ka long 1 rt $\angle.$

$\therefore OE$ u long u perp ha u **AB.**

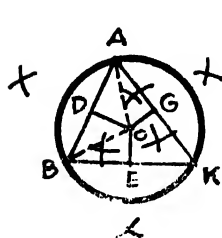
Kumjuh u **OG** u long u perp ha u **KD.**

\therefore ki perp baroh na ki pdeng jong ki *chord* ki ñashem barobor ha ka *centre.*

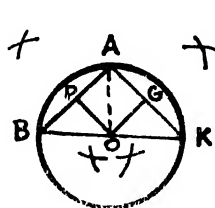
La pyndep.

Problem 19.

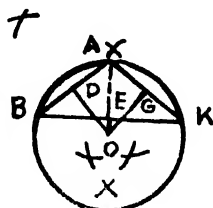
Ring circle ka ban lyngba ña ki tduh jong ki angle jong ka triangle ba la ai



(i)



(ii)



(iii)

Ai ba **ABK** ka long ka \triangle ba la ai.

La kwah ban shna *circle* ka ban ñaid lyngba .ki point **A, B** bad **K** jong ka \triangle **ABK.**

Jingshnadur—Ot marshiteng ña u **AB, BK** bad **AK**, ha ki point **O, E** bad **G.**

Ring perp ha u **D**, **E** bad **G**, bad ai kin iapom ha u point **O**.

Na u **O** kum ka *centre* bad **OA** kum u *radius* ring *circle*.

Te kane ka *circle* kan iaid lyngba u **B** bad u **K** kumjuh.

Jingpynshisha—Pyniasoh **OA**, **OB** bad **OK**.

Ha ki \triangle **ODB**, **ODA**. (i) **DB** = **DA**,
(ii) **OD** u ieng pdeng bad (iii) ka rt \perp **ODB** = ka
rt \perp **ODA**.

\therefore ki \triangle ki iaryngkat nadong shadong.

Kumta ha u **OA** = **OB**. Kumjuh u **OA** = **OK**.

\therefore u **OA**, **OB** bad **OK** ki long ki *radius* jong
ka *circle* kaba ka *centre* ka long **O** bad kan iaid lyngba
namarkata ia u point **B** bad **K**.

La dyndep.

JINGPYRSHANG 59

Ring *circle* ka ban iaid lyngba ki tduh jong ka—
(i) isos \triangle , (ii) *equilateral* \triangle , (iii) rt \perp ed \triangle ,
(iv) *obtused-angled* \triangle .

28. KA JINGPYNBYNTA IA KI ANGLE BAD IA U LAIN

Problem 20.

Phiah ta ka right angle ha ki lai bynta ki ba'aryngkat.

Ai ba **ABK** ka long ka right angle, kata kaba
= 90° .

Yn pynbynta ãa ka ha ki lai bynta kiba iaryngkat.

Jingshnadur—Nyingkong eh ngi shna ka *equilateral* \triangle ha u lain **BK**.

Na *centre* **B** bad **K** bad da ujuh u *radius* **BK** ngi ring ar tylli ki *arc* shaneng ban ãapom ha u point **D**.

Pynãasoh **DB**, **DK**.

Nangta ngi phiah marshiliang ãa ka \angle **DBK** da u lain **BE**.

Te ãa ka \angle **ABK** la phiah lai bynta da u **BD** bad **BE**.

Jingpynshisha—Namar **DBK** ka long ka *equilateral* \triangle .

Ki \angle jong ka baroh ki iaryngkat.

Kumta kawei kawei ka long $180^\circ \div 3 = 60^\circ$.

Ka \angle **DBK** = 60° .

Bad ka \angle **ABD** = $90^\circ - 60^\circ = 30^\circ$.

Bad namar ãa ka \angle **DBK** la phiah marshiliang da u **BE**.

\therefore ka \angle **DBE** = ka \angle **EBK** = 30° .

Kata, ka \angle **ABD** = ka \angle **DBE** = ka \angle **EBK**.

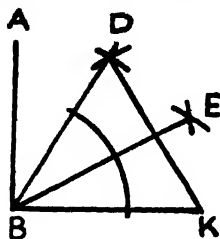
Kumta ãa ka \angle **ABK** la phiah lai bynta, kawei kawei ka angle ka long 30° .

La pyndep.

JINGPYRSHANG 60.

(Ring tang ki dur).

1. Pynbynta lai bynta kiba iaryngkat ãa ka angle kaba 180° .



(Ring ka *straight angle* **AOB**, ha kaba u **O** u long ha shiteng. Ha u **AO** shna kawei ka *equilateral* \triangle bad ha u **OB** ruh de kawei).

2. Pynbynta ha ki 6 bynta kiba iaryngkat ia ka angle kaba 90° .

(Phiah lai bynta shuwa, sa phiah ar liang ar liang ia kawei kawei ka bynta).

Problem 21A.

Ot ia ki ar tylli ki arm jong ka angle ha ki saw bynta ki baiaryngkat.

Ngi shna ka \angle **BAT** kaba 45° bad u lain **AB** uba 1".

Yn ot ia u **AB** ha ki saw bynta kiba iaryngkat, bad sa ia u **AT** de.

Jingshnadur—Ngi ot ia u **AB** marshiteng ha u **D**. Nangta ngi ot biang ia u **AD** bad **BD** mar marshiteng ha u **K** bad u **E**.

Ngi pyniasoh **BT**.

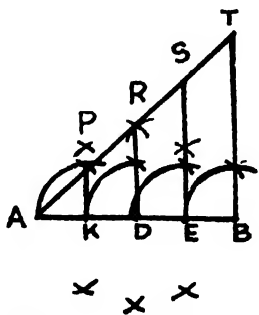
Nangta ngi ring lain **ES**, **DR** bad **KP** ban parallel ia u **BT** (da ki *set squares*) (ne bha shu shna \angle ha u **E**, **D** bad **K** kat ka \angle **ABT**), bad ki iakynduh ia u **AT** ha ki point **S** **R** ban **P**.

Da kaba ngi thew ngi shem ba—

$$\mathbf{AP = PR = RS = ST.}$$

Lada ring ia uno uno u lain na u **A** ban iakynduh ha u **BT**, ia uta u lain ruh yn pynbynta hi kumjuh ha ki saw bynta ki baiaryngkat.

La pyndep.



Problem 21B.

Ot *ia* u lain ba la ai ha ki 5 hynta ki baĩaryngkat.

Ai ba u **AB** u long u lain ba yn ot ha ki 5 bynta ki baĩaryngkat.

Jingshnadur—

Ring u lain **AK** ban ĩapynlong angle bad u lain **AB**.

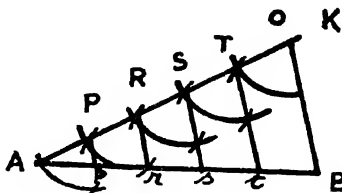
Shim kano kano ka jingjrong ka balyngkot da u *divider* (ne kãd khyndiat da u *compasses*) bad jãm san sien jãm na u **A** sha u **K**, ba kumta un ot san bynta ki baĩaryngkat, **AP**, **PR**, **RS**, **ST** bad **TO**.

Pynĩasoh **OB** bad ring lain **Tt**, **Ss**, **Rr**, bad **Pp** kiba ĩaparallel ĩa u **OB**. (da kaba pynlong \angle sha ka liang u **AO** kat ka \angle **AOB** ha u **P**, **R**, **S**, bad **T**) bad kin ot ĩa u **AB** ha ki point **t**, **s**, **r**, bad **p**.

Te ĩa u **AB** la ot ha ki san bynta ki baĩaryngkat.

Namar **Ap** = **pr** = **rs** = **st** = **tB**.

La pyndep.



KI JUBAB (ANSWERS).

JINGPYRSHANG 1.

1. 3 rukom :—u babeit, u bakhún, bad u bakdor.
2. Point : sla ne *surface*. 3. Solid. 5. Lain : point.

JINGPYRSHANG 2.

1. $3'' : 3'6''$. 2. $1'1'' ; 1'3'' ; 1'4'' ; 3'8''$.

JINGPYRSHANG 3.

1. $5'8\text{cm} ; 7'8\text{cm}$. 2. $58\text{mm} ; 78\text{mm}$. 4. $1'5'' ; 2'5\text{cm}$. 5. $10\text{cm} ; 2'4''$.

JINGPYRSHANG 4.

1. $4''$. 2. $8'4''$. 3. $14'8\text{cm}$. 4. $2'5''$. 5. $4'8\text{cm} ; 2'4\text{cm}$. 6. $1'8'' ; '9''$. 7. $4'2\text{cm} ; 2'1\text{cm} ; 4\text{ tylli} ; 21\text{mm}$. 8. $2'' = 5'1\text{cm} = 51\text{mm} ; 1'' = 25\frac{1}{2}\text{mm}$. 9. $13\text{cm} = 5\text{ }1''$. $1\text{cm} = '4''$.

JINGPYRSHANG 5.

1. $\angle \text{AOB} = 90^\circ ; \angle \text{PRS} = 110^\circ ; \angle \text{TRS} = 55^\circ ; \angle \text{PRT} = 55^\circ ; \angle \text{MWP} = 106^\circ ; \angle \text{NWM} = 74^\circ ; \angle \text{NWL} = 106^\circ ; \angle \text{LWP} = 74^\circ$.
4. Ki Complement ki long $50^\circ, 20^\circ, 75^\circ, 15^\circ, 0^\circ$.
5. Ki Supplement ki long $60^\circ, 70^\circ, 89^\circ, 113^\circ, 148^\circ, 0^\circ$.
6. Acute angle, right angle, obtuse angle, straight angle, reflex angle bad 4 right angle.
7. $50^\circ, 130^\circ, 130^\circ ;$ vertically opposite angle.

JINGPYRSHANG 7.

1. 1'5". 2. Hooïd. Ki *radius* jong kajuh ka *circle* ki iaryngkat baroh. 3. 1" baroh : hooïd. 4. 2cm baroh : hooïd. 5. U diameter = 2 shah u *radius*. Ka *arc* ka long tang ka bynta jong ka *circumference*.

6. Ki *arc* ki iapom. Haba ring lain na ki jaka ba ki iapom ki ot marshiteng ia u **AB**.

7. Em. Namar ba shim lyngkot eh ia ki *radius*. Shim pynjrang ia u *radius* u ban palat ia ka shiteng jong u 2'5".

JINGPYRSHANG 8.

1. 60° , 30° , 45° , 37° , 0° .

2. 130° , 105° , 90° , 0° , 180° .

3. (i) 60° , 120° , 120° ; (ii) 77° , 103° , 103° ;
(iii) 146° , 34° , 34° .

4. (i) 90° ; (ii) 60° , 120° ; (iii) 81° , 99° .

5. (i) 60° , 120° ; (ii) 90° ; (iii) 120° , 60° ;
(iv) 79° , 101° ; (v) 111° , 69° .

6. 33° , 57° , 45° $30'$, 54° $27'$, 85° .

7. 165° , 133° , 117° , 72° , 81° , 9° , 5° .

JINGPYRSHANG 9.

2. (a) *Equilateral* \triangle bad *acute-angled* \triangle .
 (b) *Isosceles* \triangle bad *obtuse-angled* \triangle .
 (k) *Scalene* \triangle bad *right-angled* \triangle .
 (d) Ym lah long.

3. (a) $\angle A = \angle B = \angle K = 60^\circ$. Baroh
 180° .
 (b) $\angle A = 115^\circ$, $\angle B = 32\frac{1}{2}^\circ = \angle K$.
 Baroh 180° .
 (k) $\angle A = 90^\circ$, $\angle B = 36^\circ$, $\angle K =$
 54° . Baroh 180° .
 (d) Ym lah long.

5. (a) *Scalene* \triangle bad *acute-angled* \triangle ;
 $\angle A = 80^\circ$. Baroh phar 180° .
 (b) *Scalene* \triangle bad *right-angled* \triangle ;
 $\angle A = 60^\circ$. Baroh phar 180° .
 (k) *Scalene* \triangle bad *obtuse-angled* \triangle ;
 $\angle A = 40^\circ$. Baroh phar 180° .
 (d) *Isosceles* \triangle bad *right-angled* \triangle .
 $\angle A = 90^\circ$. Baroh phar 180° .
 (e) *Equilateral* \triangle bad *acute-angled* \triangle .
 $\angle A = 60^\circ$. Baroh phar 180° .
 (g) Ym lah long ; $\angle A = 0^\circ$.

6. Ki \angle jong ka $\triangle = 2$ rt \perp .

7. Ym lah. 2 tylli na ki, ki dei ban kham jrong
 ia u balai.

JINGKYLLI KHLEH A.

2. Centre, radius, circumference, diameter, chord, arc.

3. Circle, radius, diameter.

4. Ka Complement jong ka $85^\circ = 5^\circ$. Ka Supplement jong ka $85^\circ = 95^\circ$.

6. Acute angle, right angle, obtuse angle, straight angle, reflex angle, bad 4 right angle

10. U dei ban thew bad siat hapdeng jong kita ki ar tylli ki khnam basiat ki paralok jong u. Te u khnam jong u un poi beit ha u skum.

JINGPYRSHANG 10.

1. 50 phut. 2. 13 phut. 3. 17 phut. 4. 53 kot.
5. 101 mail. 6. 25 mail. 7. 113 phut.

JINGPYRSHANG 12.

1. 50° , 65° , 90° , 90° .

2. (i) 90° ; (ii) 90° ; (iii) 90° ; (iv) 90° .

JINGPYRSHANG 14.

3. Parallelogram.

JINGPYRSHANG 17.

1. (i) 108° ; (ii) 36° ; (iii) 0° ; kam lah long.

JINGPYRSHANG 18.

2. Hooïd. 3. Hooïd. 4. Hooïd. 5. Em ;
pynjrong ãa u radius palat ãa ka shiteng jong ka 3".

JINGPYRSHANG 19.

2. Em. Ki *radius* ki dei ban long baroh ar katjuh, palat ia ka marshiteng jong ka 3".

5. Shim *centre* na u pud jong ka *circumference* bad *radius* uba 3cm ban ot ia ka *circumference*. Sa pyniasoh ia kita ar tylli ki point jong ka *circumference*.

JINGPYRSHANG 20.

3. U *chord* hangne u kylla long noh hi u diameter.

4. Ym lah don *chord* uba 5cm ha ka *circle* kaba u diameter u long 4cm.

JINGPYRSHANG 21.

3. Ki \angle kin long 90° , 180° , 360° .

4. Ki \angle ki long 90° , 180° , 360° .

JINGPYRSHANG 22.

1. (i) *Equilateral* \triangle ; (ii) *Isosceles* \triangle ;
(iii) *right-angled* \triangle ; (iv) *Scalene* \triangle ; (v) Ym lah long.

JINGPYRSHANG 23.

1. 15 phut. 2 12 phut. 3. 3 mail. 4. 30 mail.
5. Ym don jingjngai ei ci.

JINGPYRSHANG 24.

1. *Parallelogram*. 2. *Rectangle*. 3. *Square*.
4. *Rhombus*. 5. *Trapezium* ; diagonal.

JINGPYRSHANG 26.

2. (i) ka $\angle \mathbf{AKD}$; (ii) 180° ne 2 rt \perp .
 3. $\angle \mathbf{EAB} = 60^\circ$; $\angle \mathbf{AKD} = 60^\circ$;
 $\angle \mathbf{DKF} = 120^\circ$.
 4. (i) $\angle \mathbf{APR}$ alt ĩa ka $\angle \mathbf{PRD}$; ka $\angle \mathbf{BPR}$
 alt ĩa ka $\angle \mathbf{PRK}$.
 (ii) $\angle \mathbf{EPA}, \mathbf{EPB}, \mathbf{KRG}, \mathbf{DRG}$.
 (iii) $\angle \mathbf{APR}, \mathbf{BPR}, \mathbf{PRK}, \mathbf{PRD}$.
 5. (i) *Transversal* ; (ii) 45° bad 135° .

JINGPYRSHANG 27.

1. $\angle \mathbf{A} = \angle \mathbf{B} = \angle \mathbf{K} = \angle \mathbf{D} = 90^\circ$.
 $\mathbf{AD} = \mathbf{BK} = .8''$. $\mathbf{DK} = \mathbf{AB} = 1.2''$.
 3. 25 pruh : diagonal. 4. 200 kot. 5. 1.4 mail.
 6. $\mathbf{DK} = \mathbf{AB} = 2''$. $\mathbf{BK} = \mathbf{AD} = 1.5''$.
 $\angle \mathbf{B} = \angle \mathbf{D} = 120^\circ$. $\angle \mathbf{A} = \angle \mathbf{K} = 60^\circ$.
 7. $\mathbf{BK} = \mathbf{AD} = 3.3\text{cm}$. $\mathbf{DK} = \mathbf{AB} = 5.6\text{cm}$.
 $\angle \mathbf{B} = 120^\circ = \angle \mathbf{D}$. $\angle \mathbf{A} = 60^\circ = \angle \mathbf{K}$.

JINGPYRSHANG 28.

1. (a) $\angle \mathbf{A} = 80^\circ$; $\angle \mathbf{B} = 40^\circ$; $\angle \mathbf{K} = 60^\circ$.
 (b) $\angle \mathbf{A} = 55^\circ$; $\angle \mathbf{K} = 35^\circ$.
 (k) $\angle \mathbf{A} = 45^\circ$; $\angle \mathbf{K} = 45^\circ$.
 (d) $\angle \mathbf{A} = 60^\circ$; $\angle \mathbf{B} = 60^\circ$; $\angle \mathbf{K} = 60^\circ$.
 (e) $\angle \mathbf{B} = 72^\circ$; $\angle \mathbf{K} = 72^\circ$.
 (g) Ym lah long.
 (ng) $\angle \mathbf{A} = 0^\circ$; ym lah long.

JINGPYRSHANG 29.

1. 90° . 2. 90° . 3. $\angle K = \angle B + \angle A = 90^\circ$; namarkata u **AK** u long perp ha u **BK**.
 4. 45° . 5. 50° . 6. 60° . 7. 60° . 8. 120° .
 9. 130° , 130° . 10. 60° , 30° .

JINGPYRSHANG 30.

1. (i) $9'4''$. (ii) 22cm. (iii) 24 cm.
 2. (i) $22''$. (ii) 13'2cm. (iii) 30'8cm.
 3. (i) 13'86 sqin. (ii) 24'64 sqcm (iii) 98'56 sqcm
 4. (i) 13'86 sqin. (ii) 55'44 sqcm (iii) 31'175 sqcm

JINGPYRSHANG 31.

1. $49^\circ 21'$; $30^\circ 10' 31''$; $89^\circ 42' 38''$; $89^\circ 59' 55''$.
 2. $100^\circ 31'$; $25^\circ 30'$; $174^\circ 59' 1''$; $179^\circ 0' 1''$.
 3. (i) $6^\circ 40'$; $2^\circ 30'$; $4^\circ 26' 40''$.
 (ii) $96^\circ 40'$; $92^\circ 30'$; $94^\circ 26' 40''$.

JINGPYRSHANG 32.

1. (a) 90° ; 180° ; 270° ; (b) 90° ; 180° ; 270° .
 2. (a) (i) 180° (ii) 60° (iii) 270° (iv) 135° (v) 92° .
 (b) (i) $5'$ (ii) $10'$ (iii) $20'$ (iv) $12' 30''$ (v) $33' 40''$.
 3. (a) (i) 105° (ii) $157\frac{1}{2}^\circ$ (iii) $262\frac{1}{2}^\circ$.
 (b) (i) 2 kynta (ii) $2\frac{1}{2}$ kynta (iii) $3\frac{1}{2}$ kynta.
 4. $52\frac{1}{2}^\circ$; 9 kynta 20 minit.

JINGPYRSHANG 33.

1. (a) $\mathbf{BK} = \mathbf{RS} = 2.3''$; $\angle \mathbf{B} = \angle \mathbf{R} = 24^\circ$;
 $\angle \mathbf{K} = \angle \mathbf{S} = 56^\circ$.
 (b) $\mathbf{BK} = \mathbf{RS} = 5\text{cm}$; $\angle \mathbf{B} = \angle \mathbf{R} = 53^\circ$;
 $\angle \mathbf{K} = \angle \mathbf{S} = 37^\circ$.
 (k) $\mathbf{EF} = \mathbf{YZ} = 1.3''$; $\angle \mathbf{E} = \angle \mathbf{Y} = 60^\circ$;
 $\angle \mathbf{F} = \angle \mathbf{Z} = 60^\circ$.
 (d) $\mathbf{DF} = \mathbf{XZ} = 1''$; $\angle \mathbf{D} = \angle \mathbf{X} = 75^\circ$;
 $\angle \mathbf{F} = \angle \mathbf{Z} = 75^\circ$.
 (c) $\mathbf{DE} = \mathbf{XY} = 4.4\text{cm}$; $\angle \mathbf{D} = \angle \mathbf{X} = 36^\circ$;
 $\angle \mathbf{E} = \angle \mathbf{Y} = 24^\circ$.
 (g) Ym lah long.

JINGPYRSHANG 35.

1. 120° . 2. 60° . 3. $108^\circ, 108^\circ$. 4. $105^\circ, 105^\circ$.
 6. $120^\circ; 120^\circ$.

JINGPYRSHANG 36.

1. (a) Ym lah long.
 (b) $\angle \mathbf{A} = \angle \mathbf{D} = 80^\circ$; $\angle \mathbf{B} = \angle \mathbf{E} = 50^\circ$;
 $\angle \mathbf{K} = \angle \mathbf{G} = 50^\circ$.
 (k) $\angle \mathbf{A} = \angle \mathbf{X} = 90^\circ$; $\angle \mathbf{B} = \angle \mathbf{Y} = 52^\circ$;
 $\angle \mathbf{K} = \angle \mathbf{Z} = 38^\circ$.
 (d) $\angle \mathbf{A} = \angle \mathbf{L} = 60^\circ$; $\angle \mathbf{B} = \angle \mathbf{M} = 60^\circ$;
 $\angle \mathbf{K} = \angle \mathbf{N} = 60^\circ$.
 (c) Ym lah long.

JINGPYRSHANG 38.

3. 90° . 4. Baroh lai ki iakynduh lang baroh hajuh.
 5. Ki iakynduh lang hajuh baroh.

JINGPYRSHANG 39.

4. Ki ïakynduh lang hajuh hapoh ka triangle.
5. (i) Ki ïakynduh ha shiteng u hypotenuse.
(ii) Ki ïakynduh shabar ka triangle.

JINGPYRSHANG 40.

7. Parallel. 8. Parallel. 9. Parallel. 10. Hooïd, parallel.

JINGPYRSHANG 42.

1. Hooïd ; hooïd : *rhombus*. 2 Hooïd ; paralellogram.
3. Paralellogram. 4. Paralellogram.
5. *Rectangle*.

JINGPYRSHANG 43.

3. Em ; namar u **OD** bad **OE** kim ïaryngkat.
4. Em ; namar ki *radius* na ki *centre* **A** bad **B** kim long katjuh.

JINGPYRSHANG 44.

1. 90° . 2. 90° . 3. 90° . 4. 90° . 5. 90° .
6. 90° . 7. 30° , 60° .

JINGPYRSHANG 45.

2. Ki ïakynduh lang hajuh hapoh ka triangle.
3. Ki ïakynduh lang hajuh habar ka triangle.
4. Ki ïakynduh lang hajuh ha ka right angle.

JINGPYRSHANG 46.

1. Hooïd. 2. 90° . 3. 90° . 4. Hooïd ; 90° .
5. Hooïd.

JINGPYRSHANG 47.

1. (i) *Acute-angled equilateral* \triangle .
(ii) *Obtuse-angled isos* \triangle .
(iii) *Right-angled* \triangle .
(iv) *Obtuse-angled scalene* \triangle .
(v) Ym lah long. (vi) Isos. rt- \angle ed \triangle .
(vii) Isos *acute*- \angle ed \triangle .

JINGPYRSHANG 48

1. (a) $\angle B = \angle K = 58^\circ$. (b) $\angle B = 83^\circ$;
 $\angle K = 52^\circ$. (k) $\angle A = 90^\circ$; $\angle K = 30^\circ$.
(d) $\angle A = \angle B = 60^\circ$. (e) Ym lah long.
(g) $\angle P = \angle R = 72^\circ$. (ng) $\angle R = \angle S = 45^\circ$.

JINGPYRSHANG 49.

1. (i) Isos rt- \angle ed \triangle . (ii) rt- \angle ed \triangle .
(iii) Equilateral \triangle . (iv) Ym lah long.
2. Equilateral \triangle . 3. Kawei pat 80° .

JINGPYRSHANG 50.

1. (i) *Obtuse-angled scalene* \triangle .
(ii) *Acute-angled isos* \triangle .
(iii) *Right-angled scalene* \triangle .
(iv) *Right-angled isos* \triangle .
(v) *Acute-angled scalene* \triangle .
(vi) *Equilateral* \triangle .
(vii) Ym lah long.

JINGPYRSHANG 51.

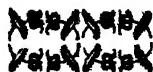
(iv) Ym lah long.

JINGPYRSHANG 53.

(iv) Ym lah long.

JINGPYRSHANG 54.

2. Ym lah long.



**Ki Kot Khasi ba lah ban ioh na ki nongdie
kot Khasi ha Shillong lane na ki
nongthoh hi harum :—**

***Da i Kong Beatrice Mittra, B. A.
Jaiaw Shillong***

1. Ka Kot Histori jong ka ñi India (IV-VI)....1T. 50 nP.

***Da u Bah Frank M. Pugh, M. A.
Jaiaw, Shillong***

2. Ka Kot Hygiene (IV-VI) 1T. 50 nP.
3. Ka Kot Geography (IV-VI) 2T.
4. Ka Drama u Shakespeare Katba phi mon 1T.
5. Ka Dañalok Nangno u Khasi u hiarpateng 1T.
6. U Khún-Syiem na ka ling u Dabid.
Kitab I 1T.
7. U Khún-Syiem na ka ling u Dabid.
Kitab II & III 2T.
8. Ka Phawar-Rwai Khasi..... 1T. 50 nP.
9. Ka Shang Syntiew.....1T. 50 nP.
- 10 Ka Geometry Thymmai.....1T. 50 nP.
11. U Khún-Syiem na ka ling u Dabid.
Kitab IV & V....2T.